COMPOSING ROOM MANAGEMENT

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COMPOSING ROOM MANAGEMENT

A Survey of present Conditions
and a Discussion in detail
of possible Improvements

By DORR KIMBALL

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By Way of INTRODUCTION

As you look over the pages of this Report you have naturally a number of questions in mind such as: What does a Survey and Report of a composing room really mean? Are the recommendations the work of a practical printer? How many of the detailed plans are actually in practice? To what extent can the suggestions for one shop be applied to another? Is the author interested in any way in selling composing room equipment?

Most of these questions, and the many more that might with reason be asked, find an answer in the text itself, but I take the author's privilege of prefacing the Report with a short statement which may serve to answer some of the most natural of your questions.

The Report which follows is the verbatim text of the document which was prepared for a certain printing firm, after making an exhaustive study of the operation of the composing room. The only change in the original wording has been to omit the name of the firm wherever it occurred, and to condense a few matters which have no more than a private interest to this particular shop. As the plans outlined in the Report are suggestions for modification of present conditions, and their carrying out will involve a considerable period of time, the firm, in granting permission to publish the Report, has naturally desired to remain anonymous.

The need for a Survey and Report of the composing room work originated in the selling end of the business. The author (who was engaged at the time in selling, designing, and planning advertising for the firm) felt the necessity of a closer co-ordination between the sales and manufacturing departments, to the end that work could be produced more economically, and at the same time the quality be improved. To work out his ideas on this subject, he was permitted to devote his entire time for a considerable period to investigating the situation and formulating his findings in the shape of a comprehensive Report.

The author makes no claim for originality in the matter of the different devices and schemes for perfecting the work. His task has been that of assembling good ideas from any and all sources, modifying and adapting them to the work at hand. A few ideas he has perhaps developed along lines that could be called wholly new in the printing industry.

The Report was made solely in the interest and from the standpoint of the management of the business. The author has no interest in any of the detailed plans, or items of equipment, other than to suggest what will prove most effective in operation.

SCIENTIFIC MANAGEMENT

You will find no mention of "scientific management" in the Report, and the reason is obvious to anyone who is familiar with the working out of the ideas originated by Mr. Frederick W. Taylor. The distance that separates the ordinary work of the printing trade, especially in the composing room, from the ideal perfection of the art, if all the principles of scientific management were applied, is so great that only the first steps can be discussed at this time.

Mr. Henry P. Kendall, of the Plimpton Press, in discussing scientific management, has given us a classification of management as unsystematic, systematic, and scientific. It must be admitted that, so far as the composing room is concerned, the average shop of today would be classified in one of the first two divisions. In some particulars the Report is dealing with conditions which might be styled unsystematic, in other particulars the conditions are somewhat systematic, but practically nowhere do we find, in present ordinary practice, conditions which can rightly be styled as scientific.

The Report is mainly concerned with the work of developing these present conditions and practices along more systematic lines, and laying the foundation for a real scientific method.

THE COST SYSTEM

Under any plan of improving the work of the composing room, the necessity of comparative records of accomplishment is at once apparent. We must know if any attempted improvement is really working a saving in cost. We must have this knowledge quickly too, for next week or next month is too late to correct present mistakes. Likewise this knowledge must be reported clearly and without red tape.

For the purpose of clear, comparative records of production costs, the so-called standard cost system proves inadequate.

In saying this and what follows, I do not wish to be understood as belittling the great work accomplished by the Typothetae and Franklin Clubs. The work accomplished by this organization in introducing cost finding has been a real life saver to the trade. Coming at a time when the only attempts to ascertain costs commonly resulted in regarding the hour's pay of the workman as the cost of the productive hour, or perhaps this cost plus a ten or fifteen per cent addition for a wholly mysterious overhead, it was a great accomplishment to convince printers that the cost of the productive hour might be the hour's pay of the workman plus a hundred or even two hundred per cent. By publishing figures of actual shop experiences and spreading the gospel of estimating jobs at rates based on average cost figures, the trade, or a considerable part of it, has been put on a fairly satisfactory financial footing.

So much the standard cost system has done, but beyond this it does not go. It does not provide the means of knowing whether actual costs are going up or down.

It is sometimes asserted that a comparison of the composing room hour costs of several months shows whether costs are going up or down, but this comparison may be widely misleading. Take this for example:

A firm has established from the previous year's records a composing room hour cost (compiled according to the standard cost system) of $1.50. The average monthly items on which this was based were as follows:

Number of productive hours . . .	1000
Total expense	$1500.00
Hour cost	1.50

The first two months of the new year gave the following figures:

January

Productive hours	1100
Total expense	$1575.00
Hour cost	1.43
Profit (7 cents on 1100 hours)	77.00

February

Productive hours	900
Total expense	$1425.00
Hour cost	1.58
Loss (8 cents on 900 hours)	72.00

From the reports of these two months in these terms, we might infer that January was a better month than February because it shows a lower hour cost, but these figures prove nothing of the kind. If we knew what was actually produced in those productive hours we might have quite a different story.

Suppose we had the average product per hour for the former year's work in convenient measurable form as representing, let us say, 500 ems of composition. (Actual cost finding of the measured product is not such a simple matter as this by any means, but this will serve for illustration.) Then the average cost of composition per measured unit of a thousand ems would be $3.00.

Suppose that during January the average efficiency of the men fell off from the average of 500 ems per hour to 455. Then the 1100 productive hours of our report represent a total measured product of 500M ems for the month. The cost per thousand ems is $3.15. Fifteen cents per thousand ems on each of 500M ems amounts to $75.00, and this is loss (not profit).

Suppose that during February the men speeded up (or found a plentiful supply of sorts in the cases instead of picking sorts) and produced an average of 555 ems per productive hour. Then the 900 productive hours produced 500M ems. The cost per thousand ($1425 divided by 500) is $2.85. Fifteen cents per thousand ems under the average for each of the 500M ems is $75.00 profit for the month.

Summarizing the reports of these two months on a measured product basis for comparison with the report on the hour basis we have:

January

Measured product (M ems) . . .	500
Total expense	$1575.00
Cost per M ems	3.15
Loss (15 cents on 500M ems) . .	75.00

February

Measured product (M ems) . . .	500
Total expense	$1425.00
Cost per M ems	2.85
Profit (15 cents on 500M ems) . .	75.00

The conclusions from the measured product report in these cases are directly opposite the conclusions of the productive hour report. Which will you use as a basis for running your business?

Productive hour records are only valuable so long as the efficiency of the hour remains constant. We know that in actual practice the efficiency of the productive hour is seldom constant. A ten per cent variation, such as is used in the above examples, does not begin to express the variation in efficiency of any one workman at different times, or of several workmen among themselves.

The importance of an accurate measure of product as a basis for cost figuring is perhaps apparent from the above discussion. To this importance is due the rather extended description of cost methods in the Report, and it is hoped that the plans there given may offer a practical solution of this, one of the most difficult of composing room problems.

THE IMPORTANCE OF THE LAY-OUT.

One principle of scientific management that has a far reaching effect when applied to the composing room is the separation of the planning of work from the actual operation.

The requirements of good display composition make the lay-out more and more necessary. With advertisers and artists continually setting definite standards of style for the printer, a new method of work is imperative both to get the results demanded and to get these results economically. There are several methods of laying out work so that a good compositor will achieve the result desired, but there is need of a standard method of lay-out and instructions in any shop which will insure economy of the workman's time. The amount of space given to lay-out work in the Report will, for these reasons, it is hoped, not seem unjustified.

A WORD ABOUT TIME STUDY

The matter of time study of operations is so prominent a feature of scientific management, that you may be disappointed in finding in the Report only a brief hint as to its application and possibilities. The reason for this can be understood by considering, for example, the work of setting type by hand. No time study of this operation can be of the slightest use in perfecting the operation unless the preliminary work of standardizing the material and the instructions to the compositor has been completed. That is to say, until you can assure the compositor that his work will not be interrupted by a shortage of type, by an uncertainty in his copy, by the necessity of finding cuts, by a question from another compositor, or by any other cause, you cannot set him a measured task and get it accomplished in a predetermined time. The Report is taken up largely with these standardizations, arranging for the type supply so that type is always in the case when required, providing lay-out and instructions so that no questions need be asked, developing a routing system so that one job follows another without a break, and so on, through all the details of the work of the department.

FULL DATA GIVEN

No apology is offered for keeping the text in the form in which it was originally prepared. The data on which the whole Report is based apply, of course, to this one shop and would not be likely to be duplicated in any other shop. But with these data given in full detail the feasibility of applying any of the plans and recommendations to other conditions can be easily judged by any printing house manager. The local conditions in any shop must be studied most carefully in any attempt at improvement. What will prove satisfactory under certain conditions will not necessarily prove satisfactory under certain other conditions. For this reason the discussion of exact conditions of work in this one shop is quite as important as the precise nature of the recommendations.

The Report does not say a final word on the art of management in the composing room. It attempts to point out how some of the vexing problems of the department may be solved in a way which will improve the product and show lessened costs.

The author's conclusions as to the best way to put in practice the recommendations of the Report may be summed up as follows:

First. Perfect the cost system and establish it in running order to the extent that an accurate daily report is secured showing the net manufacturing profit or loss over or below the assumed standards of costs. This could be done with practically no change in actual methods of production.

Second. Make the recommended changes in physical equipment with special reference to the non-distribution type system and the unit galley system of handling work. This would involve considerable time, and the effect of improvements should be clearly seen in the daily lowering of costs.

Third. Perfect the equipment service work until proving, caring for live pages, supplying full cases of type, dumping metal, and cleaning are all reduced to routine.

Fourth. Develop the lay-out system and instruct workmen in using it.

Fifth. Arrange for routing the work.

Sixth. Study and perfect the actual operations of setting, make-up, lock-up, etc., with the object of setting standards, for accomplishing which extra wages are to be paid.

Berkeley, California
April 1918

I-*Survey of* PRESENT CONDITIONS

IN LOOKING OVER present conditions of composition for the purpose of improvement, the need is apparent in two lines: first, the necessity of improving what may be called the typographical design of the product, and second, the need of manufacturing the product more economically. The proposed plan of organization in this Report is designed to meet these two needs, and its value in operation will be in direct proportion to the success with which it meets these needs.

Let us consider first the present conditions with reference to the quality of typographical design.

We shall then take up the question of the present cost of the product, analyzing such figures as are available, and attempting to estimate the approximate value of proposed changes.

TYPOGRAPHICAL DESIGN

Under present conditions the standard of typography, or style, for all jobs set is a rather uncertain thing. On some work a very high grade and definiteness of designing is furnished by the customer, and the shop's work is simply to carry out these definite specifications. On a great deal of work, however, the work comes to the shop with the rather vague requirement that it be "well displayed" or correctly set, without much recognition of the fact that there are various degrees of excellence in typography.

On this work, the results depend ultimately on the skill of the compositor who actually sets the type, limited by the necessity of using what materials happen to be available at the time. Even on work for which the specifications are rather definite, the quality of the finished product depends largely on the interpretation of the compositor and the availability of material.

The designing end of typography under present conditions, then rests either on the customer or on the superintendent or on one of the regular compositors, or in the case of specially prepared dummies and art work, on purchased lay-outs. The situation might be accurately summed up by saying that typography at present depends for its quality in designing on the skill of the workman to set the job from the material available at the time, with a suggestive and revisionary oversight from the superintendent and the salesman who is dealing with the customer.

In considering the present system of manufacture with a view to ascertaining its economy, we must ask what was the product for last year, and what was the cost of its production.

The record of product for the year May 1, 1916 to April 30, 1917, as given by the books, is 8040 productive hours, and $1583 purchased machine composition.

PRODUCTIVE HOUR COST

The cost of this product is supplied by the books in the following terms:

Composing room expense for one year

Use of equipment: depreciation, taxes, insurance on $8745	$1243
Rent of floor space	829
Supplies, rags, proof paper, etc.	90
Payroll, direct and indirect	6672
Purchased machine composition	1583
Share of cost keeping, estimated	500
Share of supervision, estimated	1000
	$11,917

This figures $1.28 per productive hour if all of the expense, except the item for machine composition, is averaged over the 8040 productive hours.

This cost price of the average productive hour includes works-costs only, and does not include selling or commercial expense. As this Report deals with the cost of work in the composing room only we are here concerned in no way with the selling and commercial expense. In comparing this figure with published figures for shops where the standard cost finding system is followed it must be noted that these published figures are usually for gross costs and include selling and commercial expense.

To have a reliable guide to the actual cost of production, we must have figures which will present the matter more in detail than is obtained by taking the gross expense and averaging it over the total number of productive hours.

The productive hour used as a basis for cost finding presupposes that these hours represent uniform amounts of work performed with a uniform value of equipment and a uniform requirement of indirect or non-productive hours. A casual glance at the work in the composing room will reveal the fact that none of these assumptions is true in actual practice. Productive hours may be employed in setting type, making up type and linotype slugs, locking forms, proof-reading with a copyholder, or proof-reading without a copyholder, resetting type as author's changes, or shifting made up pages as author's changes. Hardly any two of these operations use the same amount or value of equipment in a given hour. Hand setting large type may involve the use of $100 worth of equipment in a single hour, while proof-reading or author's changes on the press may involve the use of no additional material whatever. A productive hour used in setting type requires the service of at least a quarter hour of non-productive time for distribution, while an hour spent in making up linotype matter or locking forms requires but a few minutes of non-productive time to dispose of material.

To judge at all of the economy of production we must have figures that average only those things that because of their uniformity can be averaged.

SEGREGATING COMPOSING ROOM OPERATIONS

Let us first, then, undertake to divide up our list of expenses for the year into groups which represent different kinds of work performed in the composing room, and measure the work in each group separately. These groups may be selected as follows:

Machine set matter purchased, including linotype and monotype.
Hand set type, including only actual setting.

Make-up, involving all productive work on type or machine set matter not included in other groups.

Lock-up, both gordon and cylinder forms and for foundry.

Author's changes. This is made into a separate group because it cannot be included in any of the other groups conveniently. It applies to the operation only and does not include the use of equipment.

Insurance work, a separate department for a special product (imprinting agents' names on stationery).

Proof-reading, both that purchased with machine set matter and that done in the shop.

In attempting to divide up the items of expense correctly among these six groups, each item has to be treated individually and the apportionment made on the basis that most nearly fits the actual case. Thus the use of equipment will be divided in proportion to the equipment investment of each group, the item of rent will be divided on the basis of floor space, and the payroll according to the proportion of time devoted to work in each of the different groups. It will be seen that to make a division of any value whatever, we must work out some sort of accurate basis for measuring product and cost for each of these various groups.

Table 1 is presented as showing the completed segregation of all expense items of the composing room for last year. How this segregation is made will now be considered.

Taking up the items of expense in the same order as given in the table we shall consider each separately.

Use of equipment

This item is made up of depreciation, interest, taxes, and insurance, and can obviously be correctly apportioned among the six groups

TABLE I *Cost of production under present conditions*

		Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proofreading
Equipment investment.......	$8745	......	$4516	$3252	$ 422	......	$ 555	......
Productive hours............	8040	......	1060	2305	745	850	2000	1080
Product in actual ems.............		1830M	530M	2360M	2360M	2360M	700M	2360M
Budget for year								
Use of equipment, 14.25%...	$1243	......	$640	$465	$ 60	......	$ 78	......
Rent of floor space.........	829	......	277	277	137	......	138	......
Supplies..................	90	......	30	30	5	......	25	......
Purchased machine set......	1583	$1400	......	......	......	......	......	$ 183
2400 hrs. at 54c insurance....	1300	......	......	......	......	......	1300	......
1060 hrs. at 54c setting......	577	......	577	......	......	......	......	......
2305 hrs. at 54c make-up.....	1250	......	......	1250	......	......	......	......
850 hrs. at 54c author's.....	455	......	......	......	......	$ 455	......	......
1080 hrs. at 54c proof........	580	......	......	......	......	......	......	580
745 hrs. at 54c lock-up......	400	......	......	......	400	......	......	......
1120 hrs. at 54c distribution..	609	54	144	311	100	......	......	......
460 hrs. at 54c corrections...	250	27	58	125	40	......	......	......
2320 hrs. at 54c miscell..$1251								
Share of cost keeping.... 500								157
Share of administration..1000	2751	440	521	742	222	136	460	73
Totals.................	$11917	$1921	$2247	$3200	$ 964	$ 591	$2001	$ 737 $ 256
Cost per productive hour..........		......	$2.13	$1.39	$1.30	$ .69	$1.00	$ .68
Cost per thousand ems of product...		$1.05	$4.25	$1.36	$ .41	$ .25	$2.85	$ .42

on the basis of investment in each group. The inventory of composing room equipment, of which the figure $8745 is the total, shows a division of this equipment value as follows:

Inventory of composing room equipment

Machine composition purchased	none
Hand setting	$4516
Make-up	3252
Lock-up	422
Author's changes	none
Insurance work	555
Proof-reading	none
	$8745

The average rate charged on the books last year for use of equipment was 14.25 per cent, as shown by the total charge of $1243 for the use of $8745 worth of equipment. Applying this rate to the valuation of each group we get the figures shown in Table 1 for equipment use.

This segregation of equipment use expense is not wholly satisfactory as an example of accurate treatment of the subject. The depreciation item varies considerably for different kinds of equipment. Type is usually considered to depreciate 25 per cent per year, and other composing room equipment 10 per cent. Interest at 6 per cent, and taxes and insurance at 2 per cent, would give a total of 33 per cent for use of type, and 18 per cent for use of other equipment. The average would be considerably more than the 14.25 per cent shown above. However, the segregation as given represents the charge as actually made in the books of last year and may for convenience be left at those figures. Proof-reading and author's changes are considered groups of work involving labor only and not requiring special equipment. The slight amount of actual equipment used in this work is included in the make-up group where it is also used.

Rent of floor space

The floor space occupied by work in each of the six groups is not easily ascertained by an actual measurement of the premises, for the work of hand setting and make-up are so intermingled that they cannot be actually separated. The lock-up work and insurance division are fairly distinct. Machine composition purchased, author's changes and proof-reading are not considered to occupy separate floor space. A fair approximation at division would be to consider hand setting and make-up as each occupying a half of two-thirds of the entire room, and lock-up and insurance work each a half of the other third. The segregation of the $829 rent of floor space in Table 1 is made on this basis.

Supplies

The division of this small item is made on a rough estimate of probable use for each kind of work.

Payroll

In attempting to segregate the payroll into these six groups, we are forced to establish an average hour cost and use what records are available for determining the number of hours devoted to each group. The pay roll of $6672 is represented on the books as paying for 8040 productive hours and 4300 non-productive hours, a total of 12,340 hours. The average rate paid per hour was 54 cents.

For the insurance work we have a record of one man's full time for the year, doing the entire work: arranging orders, setting, make-up, lock-up, distributing, proof-reading, etc. We can therefore assign 2400 hours, or $1300, directly to the insurance group. This 2400 hours represents 2000 productive and 400 non-productive hours. Subtracting the 2000 productive hours from the total productive hours (8040) leaves 6040 productive hours to distribute. Subtracting 400 hours from 4300 leaves 3900 non-productive hours to distribute.

In attempting to segregate the wage cost of the 6040 productive hours into the remaining six groups, we note that none of them was spent on the group of machine setting. How then to apportion these 6040 hours, or the $3260 that they cost in wages, correctly among hand setting, make-up, lock-up, author's changes, and proof-reading.

If we had a summary of all the composing room items on the job sheets for the year, we should have a record of the number of productive hours segregated under these heads: composition (which includes setting and make-up), lock-up, author's changes, and proof-reading. As this summary is not available, the next best thing for our purpose is the record of enough individual jobs with the time record of each properly segregated, to represent a fair average of the work of the shop for the year.

In Table 2 we have a detailed record of thirty-eight jobs showing the time classified under four heads and the total.

Table 2 *Time records of representative jobs*

No.	Order No.	Description	Setting and make-up	Lock-up	Author's changes	Proof-reading	Total product hours
1	11649	Eight-page program......	6.1	.9	.7	1.7	9.4
2	11553	Thirty-two-page booklet..	43.0	5.6	4.0	6.7	59.3
3	11488	Insurance folder..........	2.0	.3	....	.3	2.6
4	11721	Four-page folder.........	.5	.1	....	....	.6
5	11759	Blank....................	2.6	.6	.2	....	3.4
6	11435	Nine ads................	16.4	8.4	8.8	3.7	37.3
7	11619	Eight-page 6x9 spread....	12.6	1.9	12.8	1.1	28.4
8	11261	Single-page circular.......	.3	.1	.3	.1	.8
9	11518	Four-page blank..........	13.7	1.2	3.6	1.3	19.8
10	11535	Order form..............	2.7	.5	....	....	3.2
11	11200	Twenty-page booklet......	3.4	1.3	2.9	3.1	10.7
12	11414	Single-page table.........	1.1	.5	....	.5	2.1
13	11681	Four-page program.......	2.8	.4	....	.3	3.5
14	11699	Single-page agreement....	1.8	.1	....	.3	2.2
15	11398	Spread..................	9.7	4.0	3.5	1.2	18.4
16	11547	Dodger..................	2.6	.1	....	....	2.7
17	10983	Six-page folder...........	5.4	.6	....	.3	6.3
18	11229	Four-page circular........	1.9	1.1	1.9	2.3	7.2
19	11642	Six-page folder...........	2.8	1.1	....	.5	4.4
20	11333	Twenty-four-page catalog..	50.8	18.9	28.3	19.5	117.5
21	10361	Eight-page folder.........	10.4	.8	3.2	.2	14.6
22	11386	Card announcement......	.6	.3	.3	....	1.2
23	11477	One-page blank..........	1.1	.2	.1	....	1.4
24	11473	Cover..................	.4	.5	.4	....	1.3
25	11463	Single-page circular.......	1.9	.1	....	....	2.0
26	11447	Single-page poem.........	1.7	.1	.2	....	2.0
27	11444	Rate slip................	1.3	.1	.4	....	1.8
28	11422	Account book...........	2.0	.3	....	.2	2.5
29	11400	Car card...............	1.7	.4	....	....	2.1
30	11409	Four ads...............	1.3	.2	....	....	1.5
31	11406	Single-page announcement.	.8	.1	.3	....	1.2
32	11351	Four-page folder.........	2.7	.4	....	.4	3.5
33	11382	Double business card.....	.7	.2	.3	.3	1.5
34	11239	Order form..............	1.4	.2	....	.1	1.7
35	11174	Single-sheet table.........	2.9	.6	....	....	3.5
36	11135	Twelve-page folder.......	3.4	.9	2.0	2.8	9.1
37	11391	Thirty-six-page catalog....	26.0	3.1	9.2	18.0	56.3
38	11418	142-page book..........	92.9	18.3	.8	42.9	154.9
Total, 38 jobs....................			335.4	74.5	84.2	107.8	601.9
Total for year's work (factor 10.03)...			3365 hours	745 hours	850 hours	1080 hours	6040 hours

It will be seen from the total that we have here a showing of approximately one tenth of the 6040 productive hours which represent the year's work after taking out the insurance item. Using this table as a basis we get the following figures for a proportionate division of the 6040 productive hours and their wage cost.

Partial segregation of direct payroll

Setting and make-up .	3365 hours	$1827
Lock-up	745	400
Author's changes . .	850	455
Proof-reading . . .	1080	580
	6040 hours	$3262

The items of lock-up, author's changes, and proof-reading can be assigned directly from this table, but the assigning of the first item involves a further calculation.

To separate the setting time from the make-up time is quite necessary for our purpose, and yet there is no direct data to be had on this division. In practice the operations were often performed together and the total time recorded as composition.

If we can ascertain the amount of type set in the setting time, and assume a rate of speed for setting, this would approximately establish the number of setting hours. This item subtracted from the total would leave a figure representing the make-up time.

Table 3 presents the actual ems of hand composition on the same thirty-eight jobs used in Table 2. (This Table 3 also shows machine composition data which will be referred to presently.)

TABLE 3 *Product record on representative jobs*

No.	Machine set actual ems	Purchase price	Hand set, actual ems
1	4390	$ 3.20	390
2	21060	22.00	1945
3	....	....	1220
4	1660	2.00	40
5	....	....	1230
6	....	....	1310
7	....	....	1340
8	1080	1.15	....
9	....	....	8860
10	....	....	220
11	19000	11.80	390
12	2812	4.00	400
13	5400	3.20	280
14	2500	1.10	450
15	....	....	3150
16	....	....	1050
17	....	....	850
18	....	....	1050
19	....	....	910
20	30000	45.50	7430
21	....	....	4335
22	....	....	325
23	....	....	730
24	....	....	140
25	....	....	505
26	600	.50	185
27	....	....	440
28	500	.50	200
29	....	....	180
30	1260	1.00	100
31	....	....	310
32	4000	2.40	390
33	1050	1.65	10
34	....	....	420
35	5400	9.15	410
36	22100	17.05	300
37	26500	32.20	2000
38	107300	62.70	9355
Total, 38 jobs	256612	$ 221.10	52850
Total for year's product	(Factor 7.15) 1830M	(Factor 7.15) $1583.00	(Factor 10.03) 530M

Applying the same factor that was used in the other case, we get a total of 530M actual ems for the year's product.

The average rate of setting all sizes of type by hand is assumed to have been 500 actual ems per hour.

On this basis the entire product of 500M ems represents 1060 hours, a wage cost of $577. Subtracting these items from the total items for setting and make-up, we get the figures for make-up, 2305 hours, $1250. These are the items used in Table 1.

Of the entire payroll we have left to segregate an item of 3900 non-productive hours, a wage cost of $2110. As part of these hours were devoted to distribution of type, make-up material, lock-up material, and dumping machine composition, we can segregate this group easily on the assumption that to distribute type, make-up and lock-up material required one fourth the time it took to set it up, or use the material in make-up and lock-up. The item for dumping machine composition is estimated. Similarly for corrections, if we estimate a sum for changing slugs on machine matter, and assume one tenth the operating time of other hand work to be spent on corrections, we get a segregation of items that takes care of another part of these non-productive hours.

There remain, however, 2310 hours of non-productive time to be segregated among the seven groups. This item cannot be connected with any group specifically, as it represents purely general or miscellaneous work. For the present it is assigned to this general group and its segregation will be discussed presently.

Purchased machine composition

This item includes not only the purchase price of the actual composition but the proof-reading as well. We can separate out the proof-reading on the basis of 10 cents per thousand ems. To measure this we must have an estimate of the actual number of ems of machine composition purchased. This is supplied by the last two columns of Table 3, made up by measuring the actual ems of machine set matter on the same thirty-eight jobs used before. The total cost of machine composition for the year ($1583) divided by the cost of the machine composition on these jobs ($221.10) gives a factor of 7.15, which, applied to the 256M ems of the jobs measured gives 1830M ems for the total year's product.

The share of cost keeping and factory administration

These are both general items which with the item from the non-productive payroll already mentioned constitute the general group whose segregation we shall now consider.

In segregating this item it is necessary to use some arbitrary method as the very fact that these charges are general makes it impossible to connect them directly with any of the groups in a purely logical way.

We might distribute this item on the basis of hours employed in the different groups, but this would give nothing to machine composition purchased, which is manifestly not exact. We might use the products of the various groups as a basis, but this would assess machine composition purchased with an extremely large proportion, and author's changes has no measured product. Perhaps the most satisfactory basis would be the total cost of each group up to this point. That is, assess each group with a share of this item of general expense proportionate to the total of its other expenses. The segregation of this item of general expense is made in Table 1 on this basis.

It will be noted that in using the averaging method of distributing this last item, we are making use of the same method that was criticised earlier in this Report. But it is only the comparatively small residue of undistributed charges that is so treated and not the bulk of the expense. The standard cost system attempts to distribute all shop expense, and all selling and commercial expense as well, on the one basis of the productive hour in the department. In this case we are distributing among seven groups of work in the department only the general department expense that cannot be directly apportioned. More than three-fourths of the total expense of the department has been directly segregated on a logical basis, the other fourth (23 per cent to be exact) is necessarily distributed on an arbitrary basis.

RESULTING HOUR RATES

Since we have a division of the 8040 productive hours into six of the seven groups, we can ascertain the cost per productive hour of each of the groups separately. Instead of one average rate of $1.28 per productive hour for the whole department, we conclude from Table 1 the following rates:

Hour costs of various composing room operations

Hand setting	$2.13
Make-up	1.39
Lock-up	1.30
Author's changes	.69
Insurance work	1.00
Proof-reading	.68

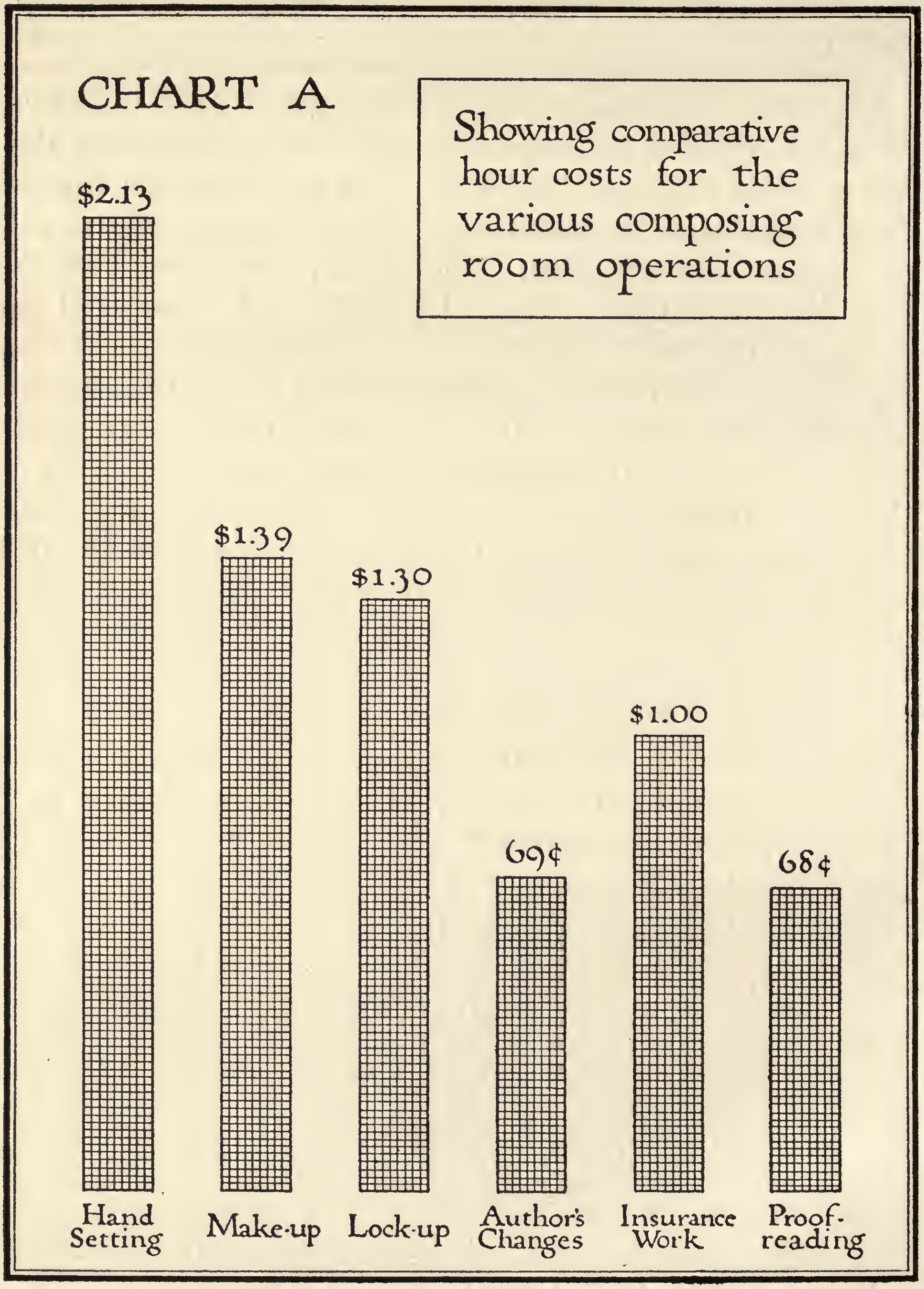


CHART A

Showing comparative hour costs for the various composing room operations

It will be noticed that in ascertaining the proof-reading cost per hour, only that portion done in the shop is considered, and this portion bears its proportionate burden of general expense alloted to the proof-reading group.

It is apparent from Chart A that wide differences of cost exist in the different kinds of work of the composing room. To average these into a single rate of $1.28 per hour for purposes of selling, or for studying efficiency, is productive of anything but clearness.

MEASURED PRODUCT RATES

As we have the measured product for all seven groups, it is interesting to note the cost of this work in terms of actual thousand ems handled. The rates follow:

Costs of thousand ems of product

Machine set matter purchased	$1.05
Hand setting	4.25
Make-up	1.36
Lock-up	.41
Author's changes	.25
Insurance work	2.85
Proof-reading	.42

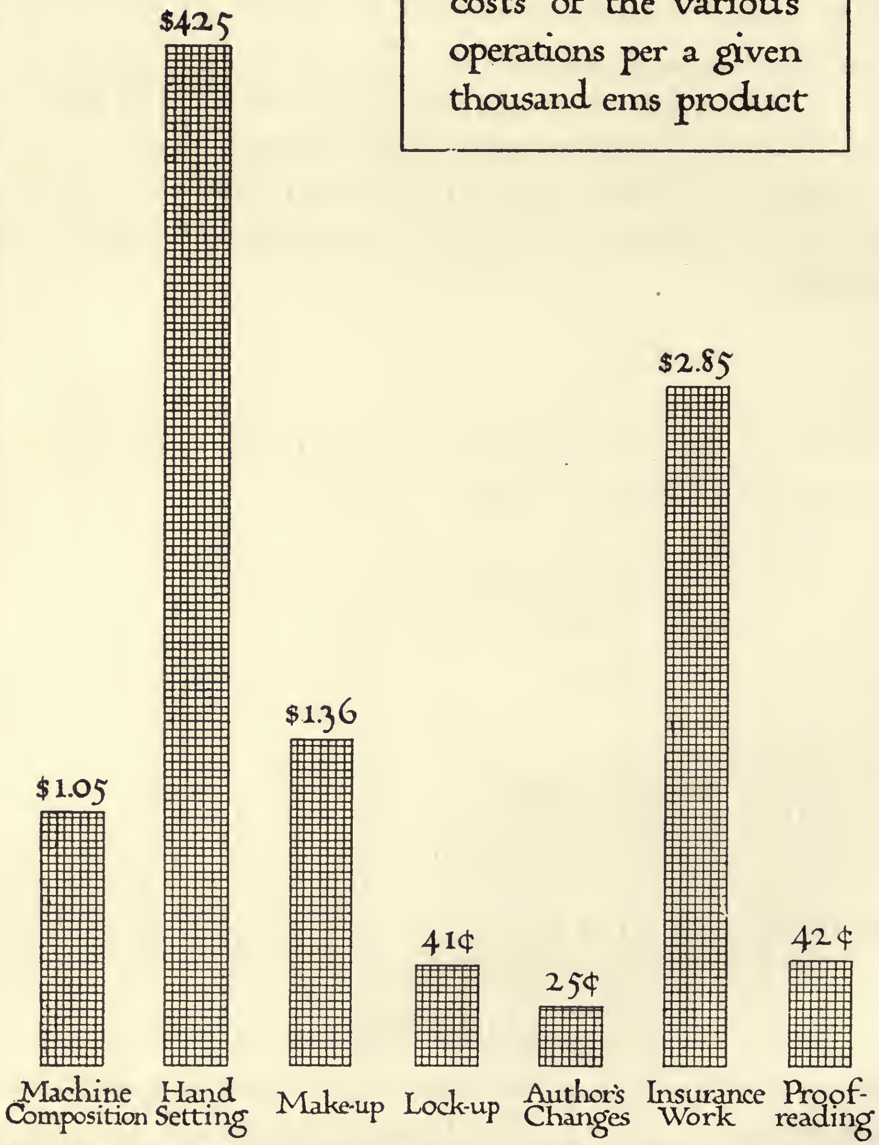
A chart of this is given (Chart B).

COMMENTS

The conclusion of the whole matter of the cost of production as far as it can be worked out from last year's figures is contained in

CHART B

Showing comparative costs of the various operations per a given thousand ems product



the last two lines of Table 1, shown graphically in Charts A and B.

A casual inspection of these figures prompts instantly a number of questions.

Why, for instance, may we ask, can insurance work, which includes, setting, make-up, and proof-reading, be done for a cost of $1.00 per hour, while for the regular work of the department, the setting rate is twice as much, and the make-up rate is half again as much? Or, looking at the same matter of insurance work and regular work, why can insurance work be done for $2.85 per thousand ems complete for all operations, while regular work costs, $3.24 for all operations if machine set ($1.05 for purchased machine set matter, $1.36 for make-up, $.41 for lock-up, $.42 for proof-reading) or $6.44 if hand set ($4.25 setting, $1.36 make-up, $.41 lock-up, and $.42 for proof-reading)?

If, as the figures show, purchased machine composition costs $1.05 per thousand ems, we may ask why not install a machine and set this amount of matter instead of purchasing it?

Again, we notice that the cost of make-up (per thousand ems of matter handled) is more than the total cost of machine set matter, and more than half the cost of hand set matter. Why this high price for what is apparently a simple operation?

Looking at Table 1, we note the striking difference in equipment requirements for the different classes of work. The insurance work is done on an equipment investment of 79 cents per thousand ems product, while hand composition requires $8.50 per thousand ems of product.

Why should proof-reading cost 42 cents per thousand ems, when 5 cents a thousand for each reading is often considered ample, and the cost rate of the first reading on three-fourths of the product was actually but ten cents per thousand ems? Apparently this item costs considerably more than the current market price.

Instead of taking up these questions that readily suggest themselves on studying Table 1, let us consider the general policy in the matter of equipment, considering first the cost of type equipment and the machine composition purchased, as compared with the cost of installing and operating a machine.

Following this we will turn to the general subject of efficiency in management and undertake to suggest a plan of organization and operation which when put in operation will produce the product economically.

II-TYPE EQUIPMENT

OF THE MANY PROBLEMS that are suggested by a study of Table 1, we shall take up now the question of general policy regarding equipment for the composing room, discussing first the matter of type equipment for hand setting, and then the possibilities of the linotype and monotype. In the foregoing survey we arrived at a cost rate of $4.25 per thousand ems for hand composition. This is the average rate for all sizes from 6 to 72 point.

As each size type presents its own particular costs, this average cost rate is absolutely meaningless when applied to any one size. To get at the real facts, we must do for hand setting and its average rate of $4.25 per thousand, just what we did in the case of the average productive hour rate of $1.28 for the whole department, namely, divide the cost up into as many groups as there are different classes of product and find the cost rate for each group.

The type equipment required for setting a thousand ems varies from a matter of one and three-quarters pounds in the case of 6 point to 252 pounds in the case of 72 point. The grouping of costs will then have to be by sizes, and we shall consider thirteen sizes: the point sizes, 6, 8, 10, 12, 14, 18, 24, 30, 36, 42, 48, 60, and 72. The old sizes 11 point and 20 point will be considered as 10 point and 24 point respectively.

This complete segregation is shown in Table 4. The data on which the segregation is made will now be presented.

The segregation of equipment valuation is made on the basis of an actual measurement by weight of the type of various sizes in the cases on July 10, 1917. This inventory is given in Table 5. The total equipment valuation of $4516, which includes the value of type cases and stands, is segregated according to the total weight of each size by using the factor 83.4.

The segregation of the total product, represented by 530M ems, is made by actually measuring the product for each size on the thirty-eight jobs before referred to, as representing practically one-tenth the total product. In assuming that the same proportionate segregation holds true for the whole product of hand setting for the year we have endeavored to correct accidental proportions in the jobs measured by charting the figures and using a smooth curve instead of an irregular one.

Table 6 and Chart C supply the data for the segregation of the product into thirteen groups.

In segregating the item of hand setting expense, equipment use is divided on a basis of investment, and the sum of all other expenses is divided on the basis of number of ems product. It is assumed in the absence of actual data, that labor items will run fairly uniform for setting and distributing type of different sizes.

The total of expense in each group is shown and the rates found by dividing each total expense by the product for that group.

We see that instead of an average rate of $4.25 per thousand ems for the cost of setting type by hand, we have various rates from $3.75 to $33.00 per thousand according to what size type is employed and what proportion this size has to the whole product.

TABLE 4 *Cost of hand setting by sizes of type*

		6	8	10	12	14	18	24	30	36	42	48	60	72
Equipment value...	$4516	$300	$392	$660	$730	$363	$430	$381	$180	$276	$101	$316	$211	$ 176
Product in ems.....	530M	60M	70M	105M	131M	60M	60M	20M	10M	7M	3M	2M	1M	1M
Use of equipment...	$ 640	42	56	93	103	52	61	54	25	40	14	45	30	25
Rent of floor space..	$ 277													
Supplies...........	330													
Setting............	577													
Distribution........	144													
Corrections........	58													
Miscellaneous......	521													
	$1607	182	212	320	397	182	182	60	30	21	9	6	3	3
Total..........	$2247	224	268	413	500	234	243	114	55	61	23	51	33	28
Rate per M........	$4.25	3.73	3.83	3.92	3.82	3.90	4.05	5.70	5.50	8.71	7.66	25.50	33.00	28.00

TABLE 5 *Type inventory*

Face	6 pt.	8	10	12	14	18	24	30	36	42	48	60	72	Total
Caslon	14	73	87	77	63	54	51	27	17	19				482
Caslon italic		14	20	15	20	14	14							97
Cheltenham	9	22	196	35	134	26	22	7	6		18			475
Cheltenham italic			27	9	19	11	16							81
Cheltenham bold	10	11	17	14	17	18	17	14	44	50	62	67	48	389
Caslon bold	23	59	43	61	17	29	22	20	16		31			321
Caslon bold italic	4	8	11	9	10	13	13	11	6		10			95
Bookman	6	7	20	20	13	26								92
Bookman italic				7										7
Bodoni shaded							5							5
Chelt. bold outline				5					6		24		49	84
Chelt. bold shaded						5								5
Antique shaded					3	4	9							16
Eng. shaded	6			12										18
Avil	9	27	52	82	37	44	26	34	34		50	52		447
Bodoni	20	32	53	37	39	35	37	25	50	14	18	25	25	410
Bodoni italic		3	3	4		7	4							21
Della Robbia	12	10	24	26		12	13		24		31			152
Ronaldson	21	48	35	19										123
Wayside	56	66	47	100		4								273
Wayside italic	13	9	7	9										38
Cushering italic		6	5											11
Law italic			22	18										40
Eng. Old English		1	6	14	8	17	15	11	8	15				95
Washington text			6	7	8	4	5							30
Plate text		2	4	4		5	4		6					25
Wedding text				3	8	8								19
Tiffany upright				3	5	9	10	7	7		9			50
Tiffany script				4		14	12	6			10			46
Gothic outline						7	24		5	10	10			56
Blair gothic	9			16		6	6							37
Wedding gothic	5	8	3	3										19
Light gothic	4	2	3	3		5	6							23
Copperplate gothic, light	27			15		3								45
Copperplate gothic, heavy	24			25		9	10							68
Lining gothic	45	12	12	6		6	6	10	13					110
Gothic condensed		6	6	5	9	5	8	5	7	6	11	20		88
Globe extra condensed gothic	6	4	4	8	4	13	9	5	5		18			76
Pabst				29										29
Typewriter			20	67										87
Ad type	6	5	21	27		27	17		20		37	45	50	255
Plymouth cond.	4	9	12	12	10	23	21		20		12			123
Plymouth italic	3	5	10	7		13	14	18	19		15			104
Post	4	6	8	14	13	16	18	16	19		13			127
De Vinne												44	39	83
Cloister old style		8		21		9	19			8				65
Litho antique	8	8	10	4		7	6							43
Pabst italic				5										5
Engravers bold	12			15		7								34
Total type	360	471	794	876	437	515	459	216	332	122	379	253	211	5425
Total equipment	$300	392	660	730	363	430	381	180	276	101	316	211	176	4516

Table 6 *Number of ems by sizes in product*

	Total	6 pt.	8	10	12	14	18	24	30	36	42	48	60	72
1	390					320	50		20					
2	1945			250	135	910	310	280	50		10			
3	1220	200			1000		20							
4	40				20		20							
5	1230	300	900	20			10							
6	1310		100	70	680	440			10			10		
7	1340						410	550	290	80				10
8														
9	8860	2400		2200	4200	60								
10	220	100		100			20							
11	390	120	200	50			20							
12	400		400											
13	280				230		20	30						
14	450			100	300		40	10						
15	3150			70	10	800	1760	200		280		30		
16	1050			60	300	120	400	100	20	25		15		10
17	850		100	360	300		80					10		
18	1050	480	140		170	250	10							
19	910			320	500	80	10							
20	7430	130	1780	2590	1560	400	630	340						
21	4335	500	1000	2250	360	40	165			20				
22	325		200	75	30		20							
23	730				700	30								
24	140	20			100		20							
25	505		100	125	120	120	20		20					
26	185		60	100				25						
27	440		200	150	60	15	15							
28	220			100	100									
29	180									40		100	40	
30	100								100					
31	310	150	100	40			20							
32	390				350		30			10				
33	10				10									
34	420	240	150			30								
35	410		160	150	40	20	30							
36	300				150	100	50					10		
37	2000	60		240	200	720	700	50	30					
38	9355	1150	1120	1465	2640	1360	1170	290	110	40	10			
	52850	5850	6710	10885	14265	5815	6050	1875	650	495	20	175	40	20
For year 530M (Factor 10.03)		58M	67M	109M	143M	58M	60M	19M	7M	5M	.2	2M	.4	.2
Revised to conform to curve		60	70	105	131	60	60	20	10	7	3	2	1	1

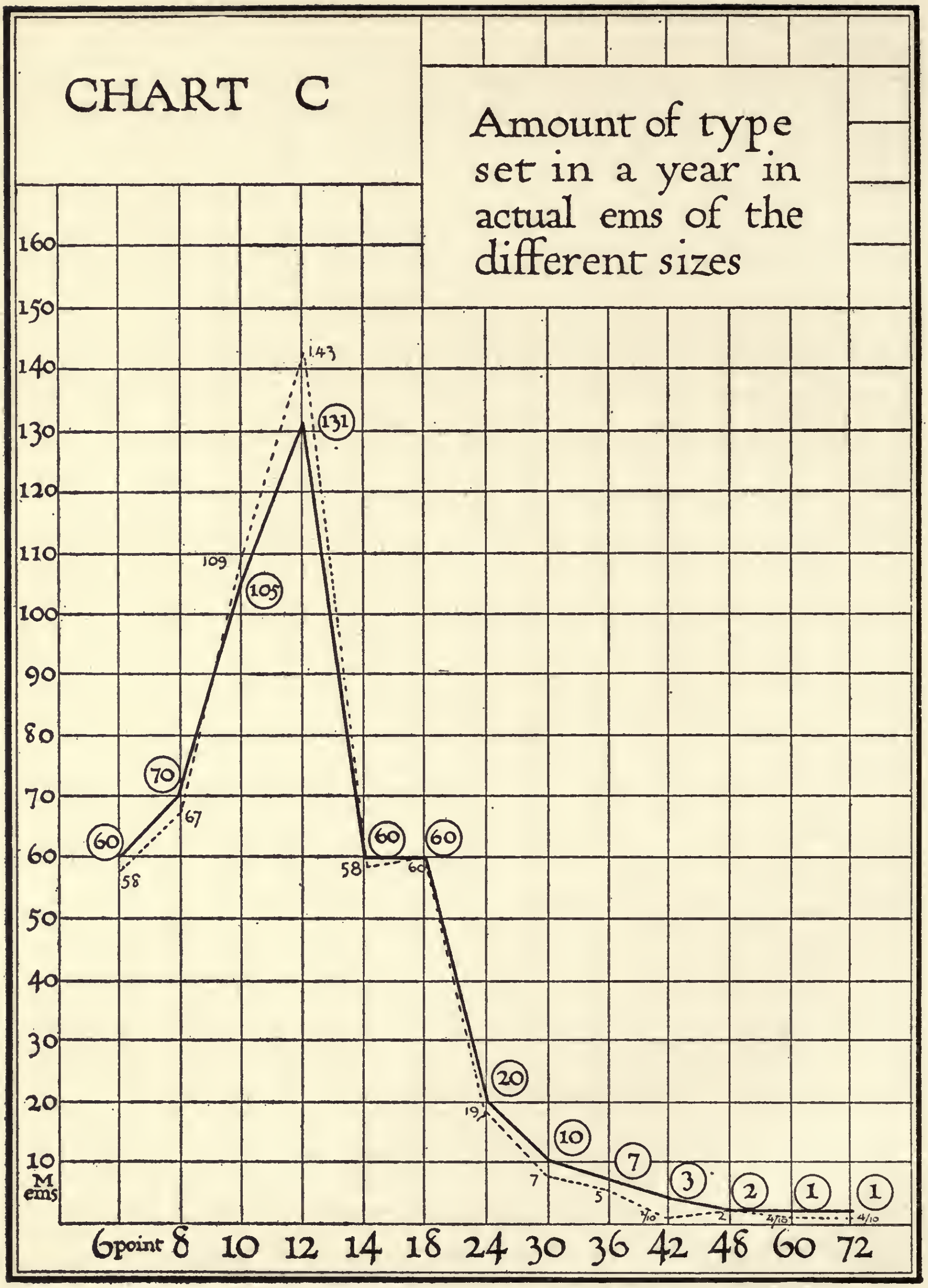


CHART C

Amount of type set in a year in actual ems of the different sizes

It is seen from this segregation of rates for different sizes that the equipment in type is a matter of paramount importance and we can now ask, Is the present type equipment efficient for turning out the product required? In each of the thirteen groups now segregated what may be said to be an adequate investment for producing the product of that group?

If we translate the product represented by a total of 530M ems into terms of pounds of type set up in each size of the exact number of ems required for each size, we get the following figures:

TABLE 7

Point size	Total product in ems	Pounds to thousand ems	Pounds for product
6	60	2	120
8	70	3	210
10	105	5	525
12	131	7	917
14	60	10	600
18	60	16	960
24	20	28	560
30	10	44	440
36	7	63	441
42	3	86	258
48	2	112	224
60	1	175	175
72	1	252	252
			5682

This amount of type in pounds for each size will actually set the total number of ems called for in each size, but there are two factors that modify these figures in determining the type supply actually to use in practice.

The first of these considerations is that of "turn-over," how many times, for example, is the 6 point type used in producing the 60M ems set in 6 point in the year? Obviously if it can be used twice, but half the supply need be provided, if every time it is used it can be used and returned to the case within an average period of a month, then but one-twelfth of the supply need be provided. If this type is out of the case on the average of two weeks every time it is used, then but one-twenty-sixth of the supply need be provided.

For the sake of figuring the type supply I have assumed the turn-over to be fifteen times during the year for the actual type needed to set the given product. This provides for an average period of tie-up on jobs of all matter of twenty days.

The influence of this first consideration of turn-over, then, is to reduce the total requirements for the year as shown in Table 7 by dividing by fifteen.

But another consideration must be reckoned with in deciding on the type supply, the amount of dead type left in the case after some letters are exhausted, and the extra supply needed because more than one style of each size of type is required for the work.

This is one and the same problem of what factor to use to cover the actual requirements in comparison with theoretical requirements. Narrowed down to actual practice the question is mainly how many styles of type are required to set the product.

We may ask what is the current best practice of the trade in regard this matter of type styles?

The history of typography in United States from the time of

Benjamin Franklin to the present is especially instructive as we note the varying degrees of complexity of type equipment in vogue at different periods.

Franklin's printing was done entirely with one series of Roman with its italic and a few fonts of text letter. From Franklin to the early days of De Vinne was a continual growth in complexity and variety and multiplicity of type faces which reached its climax in the weird and grotesque styles that are associated with that not very remote period when bent rule work and curved lines were the everyday occupation of the men who were supposed to set type. With the consolidation of the type foundries (which did not help a great deal except to limit the varieties of one face from a possible twenty to two or three) and especially with the coming of machine composition, the trade seems to have waked from its absurd position of trying to supply each customer with a full range of styles from wedding script to letters designed in imitation of rustic logs fantastically arranged, and tackled the problem of setting matter in the style of type best suited to convey the message it was supposed to convey. Among the various attempts to fit the type equipment to the needs of the job the work of the Curtis Publishing Company, in their composition of ads in the Saturday Evening Post and Ladies' Home Journal, stands as perhaps the best example of the modern scientific handling of the problem. While setting ads for the Post is somewhat different from general job composition and the exact list of faces used in one case cannot be bodily "lifted" for our use, the conclusions reached by the Curtis Publising Company are a valuable guide as to what may be done in the simplification of type styles and the improvement in typography. On the Curtis publications the type equipment is limited to a light face Roman, (a modified Caslon) three kinds of medium Roman (Cheltenham, Bookman and Kennerley), two kinds of heavy Roman (Cheltenham Bold and Caslon Bold). Each face has its corresponding italic. This equipment takes care of much wider range of display than is required by most job offices and does it with more noteworthy quality in typography.

In the light of current tendencies in display to simplicity and the observation of the rule of finding the best of various means of accomplishing a given purpose and concentrating on that one, I believe a satisfactory regular type equipment for the composing room could be specified to contain but three faces and their italics: a light face Roman, a medium Roman and a bold face Roman.

In addition to these six faces it would, of course, be necessary to have a small supply of special faces for definite jobs that are contracted for or kept standing. The special supply would be provided for separately in the budget for hand setting type equipment.

With six faces necessary to suit the style requirements of the product what supply of each will meet the demands on each size? If we had proofs of the actual product for the year working under this system of six type faces we could readily ascertain about the proportionate requirements of each style, and yet even that would not be an exact basis for providing the equipment, for the demand for any one of these six styles cannot be regarded as uniform. To meet the requirements in the present case I would suggest that we multiply the actual requirements by four because of the division of the supply into six styles, and because cases cannot be set clean. In practice this would work out something like this, there would be, say, two styles, each with a sufficient supply to set the entire product of the department, and four other styles each with sufficient supply to set half the entire product. This may seem like too generous a provision but it must be remembered that this supply is planned to be adequate to the degree that there is always assurance of sufficient type available to set any job according to layout without the danger of having to pick sorts or change the style because the style specified is unavailable. This supply is for a comparatively small amount of product (less than two thousand ems, actually, are figured as being set in a single day). A larger product would not require so great a proportion of "idle" type and considerably more product can actually be set with the equipment here specified.

TABLE 8

Point size	Light	Medium	Bold	Light italic	Medium italic	Bold italic	Total
6	8	8	4	4	4	4	32
8	14	14	7	7	7	7	56
10	35	35	18	18	17	17	140
12	64	64	32	32	32	31	255
14	38	38	19	19	18	18	150
18	64	64	32	32	32	31	255
24	38	38	19	19	18	18	150
30	30	30	15	15	14	14	118
36	30	30	15	15	14	14	118
42	17	17	9	9	9	8	69
48	15	15	8	8	7	7	60
60	11	11	6	6	6	5	45
72	18	18	9	9	9	9	72
							1520

The factors modifying the type supply shown in Table 7, then, are 15 (for dividing the product) and 4 for multiplying the product.

Using these factors and dividing the type according to the six styles we get the foregoing for what we may call the standard type requirements of our product in pounds according to size.

Extra cases would be necessary to supply the 12 and 18 point fonts of light and medium type but the other 74 fonts would each require but one job case. This figures 82 cases for the regular equipment.

In addition to the actual type spaces and quads would be required, say to an amount of 200 pounds.

Type for special jobs and faces not included in the above list may amount to say 300 pounds and be accommodated in 14 cases.

Two stands with 48 cases each with working tops and a small supply of leads and slugs will complete the proposed equipment for hand setting.

The value of a standard equipment (purchased new) for hand setting type can be estimated as follows:

1600 pounds type at 60 cents per pound	$960
200 pounds spaces and quads at 50 cents	100
300 pounds special fonts at 60 cents	180
200 pounds leads and slugs at 30 cents	60
2 stands, working tops, with 48 cases each . . .	200
	$1500

The use of this equipment may be figured as follows:

$1140 type, depreciation 25 per cent, taxes and insurance 2 per cent, interest 6 per cent, total 33 per cent per year	$377
$360 other equipment, depreciation 10 per cent, taxes, insurance 2 per cent, interest 6 per cent, total 18 per cent	65
	$442

In using Table 1 as a basis for figuring comparative costs, it seems wise to alter the percentage rate for use of equipment there shown as 14.25 per cent. This figure as pointed out, is not enough to cover a fair rate of depreciation, interest and taxes on the investment. For the purposes of rate determination it is safer to have this item higher than the actual rather than lower. We are here concerned with the single idea of loading the rate sufficiently to make an adequate return for depreciation, interest, taxes and insurance, and not in any way concerned with insurance inventory value, or replacement or salvage value. If the use-rate is figured liberally and experience can show a saving from this rate, this becomes an item of real money profit. If, however, the use-rate is figured at a lower rate and experience shows a loss, this means a real money loss.

In the following comparisons the use-rate for all classes of equipment (except type) is figured at 18 per cent of the investment: 10 per cent depreciation, 6 per cent interest, and 2 per cent insurance. Type is figured to depreciate 25 per cent instead of 10 per cent owing to its intense use and quick wearing.

The type equipment shown in Table 1 is so large for the use demanded of it that a 10 per cent depreciation may be considered

TABLE 1a *Cost of production under present conditions*

		Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proof-reading
Equipment investment	$8948	......	$4516	$3252	$ 625	......	$ 555	......
Productive hours	8040	......	1060	2305	745	850	2000	1080
Product in actual ems		1830M	530M	2360M	2360M	2360M	700M	2360M
Budget for year								
Use of equipment, 18%	$1611	......	$813	$585	$113	......	$100	......
Rent of floor space	829	......	277	277	137	......	138	......
Supplies	90	......	30	30	5	......	25	......
Purchased machine set	1583	$1400	......	......	......	......	......	$ 183
2400 hrs. at 54c insurance	1300	......	......	......	......	......	1300	......
1060 hrs. at 54c setting	577	......	577	......	......	......	......	......
2305 hrs. at 54c make-up	1250	......	......	1250	......	......	......	......
850 hrs. at 54c author's	455	......	......	......	......	$ 455	......	......
1080 hrs. at 54c proof	580	......	......	......	......	......	......	580
745 hrs. at 54c lock-up	400	......	......	......	400	......	......	......
1120 hrs. at 54c distribution	609	54	144	311	100	......	......	......
460 hrs. at 54c corrections	250	27	58	125	40	......	......	......
2320 hrs. at 54c miscell..$1251								
Share of cost keeping.... 500								157
Share of administration..1000	2751	440	521	742	222	136	460	73
								$ 737
Totals	$12285	$1921	$2420	$3320	$1017	$ 591	$2023	$ 256
Cost per productive hour		......	$2.28	$1.44	$1.36	$ .69	$1.01	$ .68
Cost per thousand ems of product		$1.05	$4.56	$1.41	$ .43	$ .25	$2.89	$ .42

TABLE 9 *The effect of standardizing the type equipment*

		Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proofreading
Equipment investment.......	$5932	......	$1500	$3252	$ 625	......	$ 555	......
Product in actual ems.............		1830M	530M	2360M	2360M	2360M	700M	2360M
Budget for year								
Use of equipment, 18%.....	$1240	......	$ 442	$ 585	$ 113	......	$ 100	......
Rent of floor space.........	690	......	138	277	137	......	138	......
Supplies..................	90	......	30	30	5	......	25	......
Purchased machine set......	1583	$1400	......	......	......	......	......	$ 183
2400 hrs. at 54c insurance...	1300	......	......	......	......	......	1300	......
1060 hrs. at 54c setting......	577	......	577	......	......	......	......	......
2305 hrs. at 54c make-up.....	1250	......	......	1250	......	......	......	......
850 hrs. at 54c author's.....	455	......	......	......	......	$ 455	......	......
1080 hrs. at 54c proof........	580	......	......	......	......	......	......	580
745 hrs. at 54c lock-up......	400	......	......	......	400	......	......	......
1120 hrs. at 54c distribution..	609	54	144	311	100	......	......	......
460 hrs. at 54c corrections...	250	27	58	125	40	......	......	......
2320 hrs. at 54c miscell..$1251								
Share of cost keeping.... 500								157
Share of administration..1000	2751	440	521	742	222	136	460	73
Totals.................	$11775	$1921	$1910	$3320	$1017	$ 591	$2023	$ 737 $ 256
Cost per thousand ems of product...		$1.05	$3.60	$1.41	$ .43	$ .25	$2.89	$ .42

adequate in figuring its use-rate. On this account the use-rate for all equipment listed in Table 1 is figured at 18 per cent.

Another small change is made in the figure in Table 1 that represents the lock-up investment. Through an evident error of the inventory, chases were not included in the composing room equipment. As the lock-up operation should include the use of chases the addition of $203 is made to lock-up equipment making the total $625.

As this standard type equipment will be considerably smaller than the present equipment it will occupy less floor space. The floor space required is estimated at 200 square feet as compared with about 400 square feet for type equipment at present. The item of rent of floor space, then, will be cut in half by the new plan.

Table 1 is here repeated, with these minor corrections, for comparison with Table 9, which shows the modifications caused by standardizing the type equipment.

The total effect of standardizing the present type equipment may be said to be a saving of $510 on the year's budget, which reduces the hour rate to $1.80, and the thousand em rate to $3.60

III-MACHINE COMPOSITION

WHEN WE CONSIDER the possibility of setting machine composition on the linotype instead of purchasing it as at present, we are concerned with the item of $1400 on Table 1 under the heading of machine set matter, and the substituting for it of an item of equipment use, an item for rent of floor space, an item for supplies and an item for operation wages. Taking these considerations up in order, let us consider each separately.

An equipment investment of $4500, representing the machine installed, with complete equipment of mats, etc., to set the present product, and metal, would figure the following charge: depreciation 10 per cent, interest 6 per cent, taxes and insurance 2 per cent, a total of 18 per cent on $4500, or $810.

Floor space we may estimate at 100 square feet at 66 cents, which gives an item of $66 for the year.

Supplies for the linotype would consist of say $100 for power and gas and $25 miscellaneous supplies, a total of $125 for the year.

Note: The market prices of type, linotype and monotype equipment have all been considerably advanced since the figures used in this Report were compiled.

Wages may be computed at 60 cents per hour for setting at the rate of 2500 actual ems per hour (corrected matter) a total of direct time of 734 hours or $440.

The expense of dumping the product remains the same, while corrections as a separate item is eliminated (it is included in operation charges).

The share of cost keeping and factory administration as well as the share in the miscellaneous time of the whole department is not changed by the addition of the machine.

Summing up the expense figures we have:

Use of equipment	$810
Rent of floor space	66
Supplies	125
Pay roll addition (direct)	440
Dumping metal	54
Share in general expense	440
	$1935

As the total of the machine set cost column in Table 1 is $1921 it will be seen that the cost under the present arrangement is practically the same as it would be in case a linotype were installed.

No saving would result from the installation of a linotype to take care of the 1830M ems product. If some of the insurance product could be switched to the machine the possibilities of saving would be somewhat greater, but hardly enough to warrant the comparatively large investment for the total product as it stands at present.

MONOTYPE POSSIBILITIES

In the case of the monotype the installation of the machine would affect not only the machine set and insurance work column of Table 1 but also the hand setting and make-up columns.

Let us take up the items that would be affected by these changes, using for our basis Table 9 which shows the hand set column brought up to standard. In considering the economies to be affected by the monotype the comparisons in regard to hand setting must be on a basis of what the hand setting should be (as brought out in discussing the type equipment) not what it happens to be at present.

The total monotype equipment for setting the 1830M ems machine composition, for casting the entire type supply except those sizes larger than 36 point, and for making the entire supply of leads, slugs, (both nonpareil and pica) and rules, used in make-up, figures an investment of $6000 including metal.

The amount of type cast for the type supply for a year will be the total amount of type actually set with enough extra to provide for the dead type that will be in the cases at the end of the year. We are not now concerned with the question of turn-over as the entire supply actually used is turned but once. The weight of the actual product for the year, set in all sizes from 6 to 36 point (omitting the four larger sizes) can be figured from Table 7 as 4773 pounds. Allowing one fourth for adjusting to styles and cases we have a total casting product of, say, 6000 pounds of type for hand setting during the year, representing about 650M ems actually of type.

It is safe to estimate that this product will require to cast at least 500 hours. The hand setting equipment unaffected by the change (the 246 pounds of 42, 48, 60, and 72 point type, the cases and stands) amounts to, say, $400.

The amount of leads, slugs and rules cast for the make-up work can be estimated from the basis of the present supply, taking into account that the amount to be cast will need to be 15 times as great as the average supply used on a twenty day turn-over.

The inventory shows that of this item $3252 investment in make-up material, $1386 is for metal furniture, quotations, leads and slugs, and $750 for brass rule, a total of $2136 equipment on which the "non distribution" system would apply, leaving $1116 unaffected. It would be necessary for the monotype to cast approximately 15,000 pounds of material necessary to make-up the total product of 2360M ems. To cast this product will require, say, 1200 hours.

The keyboard unit of the monotype we can figure as a separate investment of $700 of the $6000 equipment, used for setting only and operating 730 hours, (2500 actual ems per hour).

With these figures as a guide we can now make estimates as to equipment investment and use.

Equipment

Of the total $6000 equipment, $700 representing the keyboard can be assigned to machine setting, and the proportion of the remaining equipment represented by the setting use of the caster is estimated at 600-2300 (the proportion of composition casting hours to the total casting hours) of the remaining equipment value, or $1380. The machine setting equipment, then, is $2080.

The type-casting equipment is that portion of the total equipment represented by 500-2300 of the total (without keyboard) or $1150.

The make-up material casting equipment constitutes the balance of the equipment represented by 1200-2300 of the total (without keyboard) or $2770.

The equipment valuation, then, will be $2080 for the machine setting, $1550 for hand setting, ($400 remaining unaffected and $1150 in machine added) and $3886 for make-up ($1116 remaining unaffected and $2770 in machine added). The equipment for insurance work will be changed from $555 to, say, $200 by arranging to set 600M of the 700M ems product on the monotype. This is a total increase of investment of $2409.

Equipment use is figured at a straight 18 per cent giving the new items $375 for machine setting, $280 for hand setting, and $700 for make-up and $36 for insurance work, (lock-up remaining at $13) making the total item for equipment use change from $1240 to $1504 for the year.

Floor space

For the keyboard and a portion of the caster, for machine setting, we can estimate the floor space necessary at 100 feet, or $66 per year. For hand setting the space already occupied must be increased by, say, 100 square feet to cover its share in the monotype machine. The make-up division would be reduced from former quarters by about half. The new arrangement would occupy, say, 100 square feet and to this must be added another 100 square feet to cover its share in the monotype. A total of 200 square feet at 66 cents, or $133, will be the rent charge for make-up. Lock-up and insurance work are figured to occupy the same floor space as before. This gives a total floor space of 1050 square feet amounting to $678, $12 less than before installing the monotype.

Supplies

The monotype will add about $100 to the total item for supplies and we can divide this equally among the three columns.

The pay roll

The work of the monotype is figured to occupy the time of a man (at 60 cents per hour) while doing keyboard work and the time of a boy (at 30 cents per hour) for the automatic work of the caster. The man is figured to spend also time to the amount of one-fifth of the boy's time in making adjustments and overseeing the casting. The additional pay roll for machine setting will be 970 hours man's time, at 60 cents, $582, for setting the 2430M ems product (1830M ems as previously purchased and 600M ems of the insurance work), 600 hours boy's time at 30 cents, or $180, and 120 hours man's time, at 60 cents, or $72 for casting this same product, or a total of $840 for pay roll for machine setting.

For casting the type supply the pay roll additions will be 500 hours boy's time at 30 cents, or $150, and 100 hours man's time at 60 cents, or $60; a total of $210.

For casting the make-up supply, the pay roll addition is 1200 hours boy's time at 30 cents, or $360, and 240 hours man's time at 60 cents, or $144; a total of $504.

Other changes in pay roll (from that shown in Table 9) would be as follows due to the installation of the machine: The 2400 hours insurance work, $1300, would become 1000 hours, $540, because of setting 600M ems of the product on the machine.

Distribution shown as 1120 hours, $609, would be entirely eliminated except for an item covering the dumping of the dead pages as the forms are unlocked and the distributing of the four large sizes of hand set type, amounting to 14M ems for the year. The lock-up distribution charge is left at 196 hours, or $100, and the other item figured at 4 hour's time or $2.

Corrections, 460 hours, or $250, will be decreased by the 50 hours allowed for dumping machine set matter, and increased by an item representing monotype corrections on machine set matter which can be estimated at 100 hours, or $54, making the complete item for correction 510 hours, or $277.

The indirect or miscellaneous time is figured the same as under former conditions although as a matter of fact there would be a slight modification of this item due to installing the machine. As we shall take up this matter of indirect time later and consider it as a separate proposition it is more satisfactory at present to consider the item unaffected by the installing of the machine.

Cost keeping and factory administration are figured not to be changed by the installation of the machine.

CONCLUSIONS

The conclusion of the matter of monotype possibilities for the present volume of work seems clearly a saving of $690 on the total year's budget. This affects mostly the machine set matter rate, reducing it from $1.05 to $.75 per thousand ems, and the insurance rate, reducing it from $2.89 to $2.35. The hand setting rate remains unchanged, and make-up is slightly increased.

TABLE 9 *The effect of standardizing the type equipment*

	Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proof-reading
Equipment investment.......$5932	......	$1500	$3252	$ 625	......	$ 555	......
Product in actual ems.............	1830M	530M	2360M	2360M	2360M	700M	2360M
Budget for year							
Use of equipment, 18%.....$1240	......	$ 442	$ 585	$ 113	......	$ 100	......
Rent of floor space......... 690	......	138	277	137	......	138	......
Supplies.................... 90	......	30	30	5	......	25	......
Purchased machine set...... 1583	$1400	......	......	......	......	......	$ 183
2400 hrs. at 54c insurance... 1300	......	......	......	......	......	1300	......
1060 hrs. at 54c setting...... 577	......	577	......	......	......	......	......
2305 hrs. at 54c make-up..... 1250	......	......	1250	......	......	......	......
850 hrs. at 54c author's..... 455	......	......	......	......	$ 455	......	......
1080 hrs. at 54c proof........ 580	......	......	......	......	......	......	580
745 hrs. at 54c lock-up...... 400	......	......	......	400	......	......	......
1120 hrs. at 54c distribution.. 609	54	144	311	100	......	......	......
460 hrs. at 54c corrections... 250	27	58	125	40	......	......	......
2320 hrs. at 54c miscell..$1251							
Share of cost keeping.... 500							157
Share of administration..1000 2751	440	521	742	222	136	460	73
Totals................$11775	$1921	$1910	$3320	$1017	$ 591	$2023	$ 737 $ 256
Cost per thousand ems of product...	$1.05	$3.60	$1.41	$ .43	$ .25	$2.89	$ .42

TABLE 10 *The effect of installing a monotype machine*

		Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proofreading
Equipment investment	$8341	$2080	$1550	$3886	$ 625	......	$ 200	......
Product in actual ems		2430M	530M	2360M	2360M	2360M	100M	2360M
Budget for year								
Use of equipment, 18%	$1504	$ 375	$ 280	$ 700	$ 113	......	$ 36	......
Rent of floor space	678	66	204	133	137	......	138	......
Supplies	240	50	80	80	5	......	25	......
Purchased machine set	183	......	......	......	......	......	......	$ 183
1000 hrs. at 54c insurance	540	......	......	......	......	......	540	......
1060 hrs. at 54c setting	577	......	577	......	......	......	......	......
2305 hrs. at 54c make-up	1250	......	......	1250	......	......	......	......
850 hrs. at 54c author's	455	......	......	......	......	$ 455	......	......
1080 hrs. at 54c proof	580	......	......	......	......	......	......	580
745 hrs. at 54c lock-up	400	......	......	......	400	......	......	......
198 hrs. at 54c distribution	102	......	2	......	100	......	......	......
510 hrs. at 54c corrections	277	54	58	125	40	......	......	......
970 hrs. at 60c keyboard $582								
600 hrs. at 30c runner 180								
120 hrs. at 60c operator 72	834	834	......	......	......	......	......	......
500 hrs. at 30c runner 150								
100 hrs. at 60c operator 60	210	......	210	......	......	......	......	......
1200 hrs. at 30c runner 360								
240 hrs. at 60c operator 144	504	......	......	504	......	......	......	......
2320 hrs. at 54c miscell. 1251								
Share of cost keeping 500								
Share of administration 1000	$2751	440	521	742	222	136	460	230
Totals	$11085	$1819	$1932	$3534	$1017	$ 591	$1199	$ 993
Cost per thousand ems product		$ .75	$3.65	$1.50	$ .43	$ .25	$2.35	$ .42

The total investment in the department is still less than at present, but more, by $2409, than if the present type supply were standardized.

Floor space occupied is still less than used at present, while the payroll increases $308.

Purchased machine composition of $1400 is eliminated.

Table 10, which precedes, shows the budget after installing the monotype. Table 9, which shows the budget under present conditions with type equipment standardized, is here repeated for easy comparison.

The insurance rate is figured by adding to the total $1199, the cost of 600M ems of machine set matter at 75 cents, or $450, making $1649; and dividing by 700M ems (the total product).

IV-FUNCTIONAL MANAGEMENT

The analysis of Mr. A. Hamilton Church, as set forth in "Science and Practice of Management," is convenient to adopt in resolving the whole of management into the five organic functions of Design, Control, Comparison, Equipment, Operation. The idea of this classification is that each function of management, no matter how small, may find its logical place in one of these divisions. Taken together the whole field of management is covered and nothing that is a vital part of management is left out. The classification is well described by comparing it to five air tight compartments of a ship, each is separate from all others and together they perform the important mission of keeping the ship afloat.

In the manufacture of composition the scope of the various functions is as follows:

DESIGN

This includes all specifications in advance of operation. It is the work of lay-out and copy preparation. It does not include designing or drawing sold as art work, or copy writing or planning sold as advertising, as these operations are outside the work of the composing room. Composing room lay-out consists of deciding how a job shall be set and furnishing complete working instructions for all operations.

CONTROL

This function is that of supervision, the exercise of authority. In composition it is represented by the share of the superintendent's time devoted to the composing room and has to do mainly with routing.

COMPARISON

This function includes inspection and accounting, furnishing proper data worked up to be of easiest use by the management. In composition it includes the cost system work and proof-reading.

EQUIPMENT

This function has to do with providing conditions for operation. Depreciation, interest and taxes on equipment, rent of floor space, light, heat and power and supplies are expense items having to do with this function. Distribution of type, dumping linotype or monotype metal, clearing away make-up and lock-up material, as well as the preparation and filing of cuts are part of the equipment function of composition. Handling the work between operations is also part of the function of equipment.

OPERATION

This function includes setting, make-up and lock-up and corrections. This is the actual work of making the product.

HOW THESE FUNCTIONS APPLY TO COMPOSITION

Each of these five functions acts on the whole product and acts with its own rate of efficiency. The combined effect of all functions gives the net efficiency of manufacture. All of the functions are closely interrelated in this respect, that any shortcoming of one is likely to affect the possibility of another function working to its best. If we can have a high rate of efficiency in all functions it will mean a high efficiency for the whole department.

It may be pointed out here that these five functions apply to all work of the shop and not only to the composing room. The organization of management by functions does not contemplate a separate personnel, for instance, for the exercise of the function of control for the composing room but this function is performed by the superintendent for the whole works. In this report we are dealing only with the composing room aspect of the working of these functions, but since the functional method of organization is not at present in practice for the whole shop, we shall go beyond the actual scope of this report to point out a possible working out of the personnel of the functional organization for the shop as a whole.

THE ORGANIZATION

The scheme of organization by functions centers all functions in the manager, who also looks after the sales and finance functions, which have not, strictly speaking, anything to do with production. Most of the work of the functions of production is delegated by the manager to the service man and superintendent. The superintendent assumes the direction of the functions of equipment, operation and most of the function of comparison. The function of design claims the entire time of a service man. The general office book-keeping (a part of comparison) would be under the personal control of the manager.

These three persons, the manager, the superintendent and the service man would, of course, have to work in very close cooperation to develop a harmonious system of management. As much of the sales work is intimately connected with the function of design it would be natural for the salesman to be included also in this group of manager, superintendent and service man, as what might be termed the "planning board" or "administration committee" of the house.

In practice the work of these functions as far as it relates to the personnel of the composing room may be as follows:

The function of control

Performed by the manager acting through either the superintendent or service man, and a girl assistant for the superintendent for the mechanical work of routing.

The function of equipment

Performed by a workman and boy under the direction of the superintendent (the boy also under the direction of the service man when operating the cut file). To the workman would be turned over the task of providing special material on jobs (rules, borders and cuts) and bringing these to standard dimensions, as well as looking after the type supply and make-up material. To the boy the task of proving and storing of galleys will be delegated, as well as distributing of type and the sorting up of cases.

The function of operation

Performed by several workmen under the direction of the superintendent, one capable of operating the monotype and the others capable of doing setting, make-up and lock-up.

The function of comparison

Performed by a girl acting as cost clerk assistant to the superintendent, and by a workman acting as proof-reader under the direction of the superintendent, (the girl acting as copy holder).

The function of design

Performed by a girl acting as stenographer assistant to service man for copy preparation, and specially trained workman as lay-out man under the direction of service man.

Personnel

The personnel of the composing room, then, aside from the superintendent and service man is as follows:

A lay-out man, capable also of proof-reading, preparing special material, setting type, and doing make-up and lock-up work.

Proof-reader, capable also of preparing special material, setting type, and doing make-up and lock-up work.

Material man, capable also (besides preparing special material) of setting type and doing make-up and lock-up work.

Monotype operator, capable also of setting type and doing make-up and lock-up work.

Compositor, (one or more) capable of setting type and doing make-up and lock-up work.

Clerk, part time only for composing room, assistant to superintendent for routing, cost work and copy holding, and assistant to service man for copy preparation.

Proof boy, capable of proving galleys, distributing type and filing cuts.

A flexible force

It will be seen from this tabulation that the plan is for a very flexible force in the department capable of being easily adjusted to the fluctuations in work without loss. If work should become so slack for a period that the whole work of the department could be done by, say, three men, the force could be reduced to the lay-out man and proof-reader and monotype man, all of whom would be able to perform the other operations of the department. The addition of more men to take care of an increase of work would be an addition of compositors capable of setting type and doing make-up and lock-up work only, or it might be but one of these operations. Either reducing or enlarging the working force can be accomplished without the slightest change in the system of management or the disrupting of the force already trained for the work. If the different grades of work are compensated for on the basis of complexity of the knowledge required to perform them, then the cheaper grades are the ones most affected by the variations in the supply of work, and when a workman qualifies for a higher grade of work his position is not only better paid but also more certain not to be affected by a lay off when work is slack. This puts a premium on the permanent steady force both of extra pay and steadier work and permits the increase of product with the least readjustment.

V - The Function of CONTROL

OF THE FIVE FUNCTIONS let us first consider that of control. The exercise of the function of control in the composing room, as pointed out in the preceding chapter, is mainly the work of routing performed by the superintendent. In Tables 1, 9, 10, we have an item which includes the cost of exercising the function of control in the $1000 for "share of factory administration." This item represents all work done by the superintendent, or anyone else outside the composing room force, which is not covered elsewhere in the budget. As a matter of fact, the estimate of this $1000 was taken to include the share of the superintendent's time devoted to the composing room, and such time as the salesmen put in pasting up dummies for customers or "seeing the work through the shop." The work of getting proofs in shape for the customer's OK, making dummies, etc., even if performed by a salesman is, strictly speaking, according to the division of work by functions, a part of the function of design. "Seeing jobs through the shop" no matter by whom performed is a part of the function of control. A part of this $1000 item for factory administration, then, may be taken to represent the cost of the function of control. The rest of the item represents part of the cost of the function of design. We might estimate that $800 represents the control part and $200 the design part. This is necessarily an arbitrary estimate for we have no exact time records to go on, but if we estimate incorrectly the error will be corrected when we consider the function of design. It makes no particular difference how much we estimate the share of control expense to be, in the $1000, so long as we estimate the design share to be the rest of the item, in our figures.

Eight hundred dollars, then, of the $1000 item of "share of factory administration" on Table 10, we can take as representing the cost of exercising the function of control for the composing room under present conditions.

THE COST OF IMPERFECT CONTROL

But we also have another item that measures, not the cost of control, but the cost of imperfect control. The item in all the foregoing cost tables of 2320 hours of miscellaneous time, $1251, represents the number of pay roll hours purchased for which there is no record of direct or indirect product.

After all the hours, and their wages, that can possibly be accounted for have been segregated out of the pay roll, hours of direct time on jobs, hours devoted to distribution of type, hours devoted to corrections, we still have left this item of 2320 hours for which $1251 in wages was paid. Manifestly, under present conditions the purchase of labor to perform the work of the department is performed on this basis: that 12,340 hours are purchased to do the work of 10,020 hours. We may say that to get an hour's labor, an hour and a quarter is purchased or, to put it another way, every time an hour's labor is purchased a quarter hour more is purchased whose use we cannot account for.

Now the function of control, or routing, is mainly to see that every man on the pay roll is supplied with work, and if there is no work to reduce the force accordingly. How well the function of control is performed can be measured by how closely the purchased hours agree with the hours worked. As an ideal 100 per cent working of the function of control we may say that it should account for every hour purchased.

Under any conditions of shop management it will never be possible, in all probability, to reach this ideal efficiency of 100 per cent for the function of control, there will always be some uncontrollable factors which make it impossible to adjust the day's work exactly, hour for hour, with the pay roll. The question of holding men idle so as to be on hand when rush work comes in, the question of anticipating the needs for any time ahead, the disrupting of a program by a customer's failure to return a proof promptly or by making changes so that extra work not figured on has to be done; all these complicate the performance of the function of control to a degree that makes 100 per cent proficiency out of the question. But that is not saying that the 77 per cent that represents the efficiency of the present conditions cannot be improved by perfecting a good routing system.

IMPORTANCE OF EFFICIENT CONTROL

By spending no more than the $800, the amount estimated as being spent at present for the exercise of the function of control, in the composing room, it seems feasible to say that a routing

Table 10 *The effect of installing a monotype machine*

		Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proof-reading
Equipment investment	$8341	$2080	$1550	$3886	$ 625	......	$ 200	......
Product in actual ems		2430M	530M	2360M	2360M	2360M	100M	2360M
Budget for year								
Use of equipment, 18%	$1504	$ 375	$ 280	$ 700	$ 113	......	$ 36	......
Rent of floor space	678	66	204	133	137	......	138	......
Supplies	240	50	80	80	5	......	25	......
Purchased machine set	183	......	......	......	......	......	......	$ 183
1000 hrs. at 54c insurance	540	......	......	......	......	......	540	......
1060 hrs. at 54c setting	577	......	577	......	......	......	......	......
2305 hrs. at 54c make-up	1250	......	......	1250	......	......	......	......
850 hrs. at 54c author's	455	......	......	......	......	$ 455	......	......
1080 hrs. at 54c proof	580	......	......	......	......	......	......	580
745 hrs. at 54c lock-up	400	......	......	......	400	......	......	......
198 hrs. at 54c distribution	102	......	2	......	100	......	......	......
510 hrs. at 54c corrections	277	54	58	125	40	......	......	......
970 hrs. at 60c keyboard $582								
600 hrs. at 30c runner...180								
120 hrs. at 60c operator.. 72	834	834	......	......	......	......	......	......
500 hrs. at 30c runner...150								
100 hrs. at 60c operator.. 60	210	......	210	......	......	......	......	......
1200 hrs. at 30c runner...360								
240 hrs. at 60c operator..144	504	......	......	504	......	......	......	......
2320 hrs. at 54c miscell..1251								
Share of cost keeping.. 500								
Share of administration 1000	$2751	440	521	742	222	136	460	230
Totals	$11085	$1819	$1932	$3534	$1017	$ 591	$1199	$ 993
Cost per thousand ems product		$ .75	$3.65	$1.50	$ .43	$ .25	$2.35	$ .42

TABLE II *The effect of standardizing the function of control*

		Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proofreading
Equipment investment	$8341	$2080	$1550	$3886	$ 625	......	$ 200	......
Product in actual ems		2430M	530M	2360M	2360M	2360M	100M	2360M
Budget for year								
Use of equipment, 18%	$1504	$ 375	$ 280	$ 700	$ 113	......	$ 36	......
Rent of floor space	678	66	204	133	137	......	138	......
Supplies	240	50	80	80	5	......	25	......
Purchased machine set	183	......	......	......	......	......	......	$ 183
1000 hrs. at 54c insurance	540	......	......	......	......	......	540	......
1060 hrs. at 54c setting	577	......	577	......	......	......	......	......
2305 hrs. at 54c make-up	1250	......	......	1250	......	......	......	......
850 hrs. at 54c author's	455	......	......	......	......	$ 455	......	......
1080 hrs. at 54c proof	580	......	......	......	......	......	......	580
745 hrs. at 54c lock-up	400	......	......	......	400	......	......	......
198 hrs. at 54c distribution	102	......	2	......	100	......	......	......
510 hrs. at 54c corrections	277	54	58	125	40	......	......	......
970 hrs. at 60c keyboard $582 600 hrs. at 30c runner...180 120 hrs. at 60c operator.. 72	834	834	......	......	......	......	......	......
500 hrs. at 30c runner...150 100 hrs. at 60c operator.. 60	210	......	210	......	......	......	......	......
1200 hrs. at 30c runner...360 240 hrs. at 60c operator..144	504	......	......	504	......	......	......	......
501 hrs. at 54c miscell...271 Share of cost keeping....500 Function of design......200 Function of control.....800	1771	283	336	477	143	88	296	148
Totals	$10105	$1662	$1747	$3269	$ 938	$ 543	$1035	$ 911
Cost per thousand ems product		$ .69	$3.29	$1.38	$ .40	$ .23	$2.07	$ .38

system could be developed which when put in practice would show at least 95 per cent efficiency. Details of this will be discussed further on; for the moment, let us assume this as possible and see what effect it would have on the cost of production.

On Table 10, then, we note that the item $1000, the share of factory administration, becomes two items, $800 routing, and $200 designing. This does not affect the total in any way. The item 2320 hours miscellaneous, $1251, would be reduced to 501 hours, $271. This represents a saving on the year's expense of $980 due to the standardization of the function of control. These figures are shown in Table 11 and the effect on the rates noted as well. Table 10 is repeated for easy comparison.

In figuring this change no attempt was made to apply it to the changed pay roll as affected by the work of the monotype. In figuring monotype operation it was figured at a rate which included any indirect time in the estimate for direct time, so that the question of routing is really figured at 100 per cent. The dropping of 1400 hours of insurance work (as shown in Table 10 due to the introduction of the monotype) was not figured to affect this item of miscellaneous time. For exact figuring in this matter of saving in the miscellaneous item, both these changes in the pay roll should be considered, but the result would not be materially altered except perhaps to exaggerate the saving due to standardizing the function of control.

THE RUSH JOB

In standardizing the function of control as it relates to the composing room, in order to effect the saving pointed out as possible in Table 11, two phases of the matter need to be considered; first the conditions under which work comes to the department, and second the routing of the work in the department. Both of these matters affect the work of the superintendent.

The first of these considerations is mainly a question of the "rush" job and its influence on production, and may very properly be considered in connection with the function of control, for this function is in a position to act as no other function is.

Under present conditions the rush job is permitted largely because it seems necessary to accommodate customers, and because in actual practice the rush job shows a cheaper cost than the same job would if put through with more leisure. When a job goes through the department in quick time there are fewer productive hours charged against it than if it went through at a slower pace. As the cost system records productive hours only in finding the cost of any job the rush job shows up with a lower-than-average cost as a rule. The salesman is in this position with a customer: he is anxious to hold his good will by every kind of good service, and as he knows that if the shop is pushed in the matter of time the cost on the job will probably show lower than ordinary, he is doubly anxious that a short schedule be set for the job. The exact time necessary to do the work is known only approximately, as the estimate is made on the productive hours only and takes no account of the indirect hours (which on a given job may equal the direct). The salesman and the customer, both with a desire to see the job completed on a short schedule, will perhaps take the productive hour figures on the estimate to be elapsed time for the whole job and consequently when the job comes to the composing room it is a sure enough rush affair with a vengeance.

A PROTECTIVE TARIFF

This condition can be improved by the adoption of a cost system which will avoid the error caused by measuring product by the productive hour, no matter at what speed the work is actually done, and adopting also what might be called a "protective tariff" for work that requires special service.

If the protective tariff were adopted it might be reduced to this simple rule for the composing room: all jobs which require setting, make-up, or lock-up, completed the same day as that on which the copy comes to the department, are priced at 10 per cent above the composing room standard cost rate.

This would enable the composing room to route its work for a day ahead and not have to change its schedule except occasionally. In the cases where rush jobs were necessary, the change in schedule would mean extra income for the department.

The cost system can handle this without change in its routine, as will be shown in the discussion of the function of comparison.

The result of this tariff on rush jobs would be to make the salesman anxious to avoid the short schedule; he knows the cost of the job (being based on a physically measured product and not on the productive hour) will be figured at exactly the same rate whether it is put through fast or slow and that this cost will advance 10 per cent if he insists on a short schedule. He is in the position to insist on a reasonable time in which to get out the work at regular prices or if the customer demands the short schedule has a good clear argument why this special service will advance the price over regular prices. He can still sell all the rush jobs he pleases, but he must be certain to collect the extra charge from the customer.

ROUTING

The actual work of routing jobs through the composing room is facilitated by the development of the function of design which will be discussed later. When the lay-out work is complete the job is actually divided up into accurately measured "tasks" each with a time estimate. All the superintendent has to do in actual routing is to "shuffle these cards and deal them out to the working force." In practice he will probably find it convenient to arrange a plan board with places for each workman so that, with his knowledge of the time requirements on all jobs and task cards representing the entire volume of work to be routed, he can make out a day's schedule that will be subject to very little alteration when actually worked out. The clerical details of checking the cards to see that all jobs are provided for and issuing the cards to workmen, and recording time of starting and stopping, can all be done by a girl assistant, so that the superintendent need spend but little time on the actual working of the system.

In this matter of routing every item of shop standardization contributes its share to the ease with which the work is done. In working for a smoothly running schedule, an adequate type supply, the perfection of the hand work operation, and the systematic handling of proofs, as well as the care with which the lay-outs are made, will aid materially in arriving at the standards set.

If we estimate a couple of hours a day for the share of the superintendent's time, and a couple of hours a day of the girl's time to take care of the entire function of control as related to the composing room, then the $800 allowed as the cost of this work can stand without change as representing the cost of this function.

VI-The Function of DESIGN

The development of high grade designing for typography means either the continual improvement of each of the compositors under present conditions, or the segregation of this work and putting it in charge of one or more specially trained people. The latter is offered as a feasible plan and details are worked out in the creation of the lay-out department. The design function as far as it relates to the composing room is planned to be in the hands of one man and a stenographer assistant. Customers' specifications or suggestions from the salesman or superintendent as to style are given to this lay-out man. On him is placed the responsibility of laying-out the work in such a way that the resulting job has real design value. He makes his lay-out, prepares the copy for the job so completely that the man who sets the type and makes it up can do his work in but one possible way. Absolutely nothing is left to the discretion of the compositor, his time can be devoted solely to setting and make-up.

This work of the lay-out man must necessarily represent the best skill that can be secured, and all the means to advance the art of typographical design must be at his command. It is suggested that one of the present compositors be selected for this position, and after special training in the setting and make-up of jobs from prepared lay-outs be gradually trained to the lay-out work until he can handle the work for all jobs.

How will this development of the function of design by segregating the lay-out from the actual setting and make-up affect the cost of production?

SAVING IN AUTHOR'S CHANGES

In Table 11 (and previous cost tables) we notice a column marked "author's changes" including an item of 850 hours at 54 cents wages, or $455 for the year, and an "overhead" expense item of $88.

The first effect of developing the function of design will be to so plan the work that resetting for any reason may be avoided. It will affect this item of author's changes by eliminating a large portion of it.

The author's changes reported in Table 11 represent several classes of work such as the setting and make-up of new matter added by the author to his original copy, actual changes in the copy after the matter is set, changes in arrangement (not copy changes) to improve the style or to conform to the customer's requirements, and resetting and make-up due to type face selection which the customer wishes to alter.

With the lay-out system fully developed (as will be explained later) all of these classes of author's changes can be eliminated except those involving actual additions or alterations in the original copy. For example, the necessity of resetting to meet the customer's requirements of style or type face selection, can be absolutely avoided by getting the customer's OK on the lay-out showing style and type selection before any actual setting is done.

The lay-out system is not to be regarded as working absolutely to the ideal that the lay-out is never altered in the minutest particular after being set. The changing of a lead or slug here and there, the respacing of a line or even the resetting of several words in a different type are all allowed for in the routine work of correction. In this way what might be called the unavoidable necessity of some author's changes on every job is taken care of and allowed for in the cost of composition without changing the routine system at all.

As will be pointed out in discussing the cost system in the chapter on the function of comparison, these author's changes which involve additions to the original copy are simply handled as so much additional product on the job, and since the reporting of work done is based on the product in ems, this additional product automatically gets properly priced out. In the case of actual changes in copy where the work is done by making the changes in the page or even on the press, the work is reported as time work, and the charge appears on the record of the job as a special charge at a fixed hour cost rate. In other words, the cost system is arranged to handle all author's changes which actually add to the physically measured product by recording the additional product, and any changes which do not show in the finished product by recording the number of hours spent on making the changes.

We may estimate that of 850 hours, $455, reported in Table 11 as author's changes, at least half would be avoided by the development of the function of design. In this case the item would be changed from $455 to $227, and the $228 saving on the year's expense credited as one phase of the development of the function of design.

SEPARATING DESIGN FROM OPERATION

The function of design affects other figures on Table 11 beside the matter of author's changes.

Under the present conditions the function of design in composition is exercised by each workman as he does his work. That is to say, when a man sets the type he also decides what measure he will set his stick, how he will space the matter, and what size and face of type he will use. When he makes up a page he decides what material he will use to space it out and how he will arrange that material. When he locks a form he decides what furniture and chase he will use, and usually the style of imposition he will follow.

With the development of the function of design the deciding on all these things is separated from actually doing the work.

Thus when a man sets type, the measure to set it, the spacing of the line, the type, both size and style, are all specified on the copy and he can devote his whole time to actual setting. The function of equipment, when fully developed, takes care that the type specified is always "on tap" and this same function provides for the distributing of type and standardizing cuts. It will thus be seen that the development of the function of design, to be effective, must go hand in hand with the development of the function of equipment, for any failure on the part of the equipment function to furnish perfect conditions of material makes it impossible for the workman to carry out the specifications as made out by the function of design in the copy marking and lay-out work.

In the matter of make-up the material to use and its exact arrangement is specified on the lay-out and the bill of material, so that make-up becomes strictly an assembling operation of definite material.

In the matter of lock-up the imposition is specified and also the material to use, leaving the actual lock-up operation simply that of putting the pages and furniture and quoins into the chase and locking it.

THE EFFECT ON COSTS

It seems a safe estimate to assume that when the function of design is developed to the extent outlined above it would reduce the operating time (as now reported) for setting, make-up and lock-up to half its present time rate. This is a difficult matter to judge accurately as we are dealing with an entirely new technique in handling the work. All we can say is that it is reasonable to assume that dividing the planning from the doing will not increase the total time for the operation as now performed, and may reduce it. Some operations will show more change than others. Make-up for example, will show a larger reduction than hand setting, because in hand setting the decision on what measure to set and what type to use can be made with little loss of time, while a large part of make-up time is now spent in "try and see" methods of deciding the way a page shall be displayed. In lock-up, where the imposition may have to be ascertained with reference to press room, bindery or stock requirements, the amount of time spent in deciding what to do is probably considerably more than actually doing the locking up after the particulars are decided.

For the sake of making a definite estimate of this effect of the development of the function of design, I assume that the present operating time will be reduced 25 per cent in the case of hand setting, 50 per cent in the case of make-up and lock-up. (No reduction is figured for monotype work.) Against this saving I propose to put the estimated cost of exercising the function of design.

The cost of exercising the function of design may be reduced to a piece rate for each operation based on the estimate of time necessary to do the work.

PREPARING COPY FOR HAND SETTING

The cost of copy preparation for setting by hand may be estimated at 22 cents per thousand ems. This provides for complete transcribing of the copy, the marking of all specifications of measure, type style and spacing. The cost is arrived at by specifying that all copy shall be transcribed in such a way that each MS. page contains an average of 700 ems and figuring that the transcribing can be done at the rate of four pages per hour by a girl whose wages are 30 cents per hour. Transcribing per thousand ems of copy will then figure at little less than 11 cents. Marking the copy with the necessary instructions (in accordance with a system of mnemonic symbols which will be explained later) is figured to be done by the lay-out man at a rate of 10 pages per hour at a wage rate of 75 cents per hour, or a rate per thousand ems of copy of 11 cents. The total cost, then, for performing the function of design for hand setting is 22 cents per thousand ems. As the product of hand setting is given at 530M ems for the year we find the year's cost of design for hand setting as $117. The estimated saving in the hand setting expense due to segregating the design was 25 per cent of $577, or $144. This shows a net saving for design in hand setting of $27.

PREPARING COPY FOR MACHINE SETTING

The function of design is figured to operate for the work of the monotype as well as for all other productive work and hence it is necessary to include in our costs an item for this purpose even if we have no corresponding item of saving due to reduced monotype operating expense.

For the monotype work the copy preparation will be quite as much an exact science as similar work for hand setting, but the cost per thousand ems for this work will be considerably less. This is because the 2430M ems representing the monotype setting product for the year is made up of fairly long runs of uniform character, while the 530M ems that represent the hand set product is made up of innumerable small items with a run of a couple of thousand ems as a rare occurence. The average monotype run may be around 5M while the average hand set run will be likely to be nearer 500 ems. The cost of copy preparation will follow very closely the comparative size of the runs and may be fairly estimated at 2.5 cents per thousand ems for monotype when 22 cents represents the rate for preparing copy for hand setting. For the monotype very little of the copy will have to be transcribed and the work of marking instructions as to size and type by the lay-out man will be done at some such rate as 20 to 30 pages of MS. per hour. For some classes of monotype work, intricate table work, for example, the copy preparation will require a proportionately greater amount of time, and attempting to average the cost of copy preparation on the actual thousand ems is hardly productive of exact results. This condition will be materially helped, however, by measuring intricate matter as extra price instead of on the basis of actual ems, for then the copy preparation (and proof-reading also) automatically increases in price. This will be taken up in detail in the chapter on the function of comparison where the practical use of rates is discussed. At this point it is sufficient for our purpose to consider the small inequality of copy preparation charge per thousand ems as negligible. Copy preparation for machine setting can be estimated to cost 2.5 cents per thousand ems, amounting on the year's product of 2430M ems to $60 for the year. This amount is added to our year's budget.

LAY-OUTS FOR MAKE-UP

The work of the function of design as it relates to the operation of make-up is the preparation of a lay-out showing the arrangement of all type and material in the page and the listing of the material other than type so that it can be assembled. This work is planned to be performed by the lay-out man assisted by a girl who will do most of the clerical work. In attempting to ascertain the cost of this work and express the cost as a rate per thousand ems of type handled in the make-up, we see at once that it will be necessary to use a rate which is an average of work which may not run uniformly. However, the inequalities that arise from using actual thousand ems of machine and hand set type will be partially equalized when we adopt a measured em standard (as will be explained in the chapter on the function of comparison) which, for example, makes an actual thousand ems count as two thousand ems if the work is double price matter. Counting an actual thousand ems as two thousand automatically doubles the make-up time allowance both for the preparation of the lay-out and the actual operation. We shall attempt at this point to arrive at a rate for lay-out preparation per thousand actual ems which will be a fair average. We may say that the lay-out man will prepare lay-outs (in accordance with specifications to be discussed in full later) for the make-up of both machine and hand set type at a rate of 5M ems per hour at a wage hour cost of 75 cents. That is to say that he will prepare all the specifications necessary for the make-up of 5M ems of machine set matter or hand set matter, or some of each mixed on the same job, in an hour's time on the average. This figures 15 cents per thousand ems as lay-out cost. The lay-out man will be assisted by a girl stenographer who will make up the bill of material and help check the lay-out. If we figure that she works simultaneously with him (in practice she will probably work less time than he) we must add an hour of her time, 30 cents for every 5M product, or a further lay-out cost of 6 cents per thousand ems. The total lay-out cost, then, is estimated at 21 cents per thousand ems of type to be handled. This makes the design cost for the make-up of 2360M ems for the year $496. We estimated that 50 per cent of the cost of the operation of make-up would be eliminated by the development of the function of design, which amounts to $625. Subtracting the above cost of design from this saving in operation leaves a balance of $129, representing the saving in the year's budget due to the development of the function of design in the matter of make-up.

LAY-OUTS FOR LOCK-UP

Preparing instructions for lock-up can be roughly estimated at two cents per thousand ems of type involved. This is based on the guess that the lock-up instructions for any piece of work can be figured out (by the same man who is also in touch with the press, bindery and stock requirements) in one tenth of the time it takes to prepare the lay-out instructions. A 50 per cent saving in operating time of lock-up as estimated, means $200 for the year. Two cents per thousand for 2360M ems is $47. The net saving on the year's budget, then, due to the development of the function of design for lock-up is $153.

SAVING ON INSURANCE WORK

The effect of the development of the function of design on the insurance work is to add an item covering the cost of design and reduce the item of $540 which represents 1000 hours, designing (sorting orders etc.), setting (of 100M ems type), make-up (of 700M ems machine and hand set type) and proof-reading. No lock-up operation is figured for this work as the forms are kept standing and the make-up operation performed directly in the chases.

It may be estimated that instead of the 1000 hours, $540, for all this work, 500 hours, $270, would answer if the function of design were exercised separately. The cost of the design for the insurance work would be 22 cents per thousand for the 100M ems hand set type, or $22, and 21 cents per thousand for making up 700M ems, or $147, a total cost of $169. This shows a net saving of $101 on the insurance work due to the development of the function of design. (It will be noted that the 2.5 cents per thousand ems for copy preparation of the 600M ems machine set matter in the insurance work has already been added to the machine set column whose total product of 2430M ems includes the 600M ems of insurance work.)

THE NET SAVING

On Table 11 we still have an item of $200 for share of factory administration which we pointed out in the preceding chapter represented the cost of the function of design as far as we had a separate record of its cost. As we substitute an accurate estimate of the complete cost of the function of design for the department, this item of $200 is eliminated and credited to the saving in the year's budget. As this item of $200 was distributed as a part of the miscellaneous item of indirect expense, and will be adjusted in a later table on more exact grounds, it is here credited to the make-up column.

Summing up the net changes in budget figures we find a net saving of $778 due to the development of the function of design as shown in Table 12 where the effect on the rates is also indicated. Table 11 is here repeated for easy comparison.

We shall turn now to consider the practical aspects of the working out of the function of design, and attempt to describe the system of lay-out as a whole.

TABLE 11 *The effect of standardizing the function of control*

		Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proof-reading
Equipment investment	$8341	$2080	$1550	$3886	$ 625	......	$ 200	......
Product in actual ems		2430M	530M	2360M	2360M	2360M	100M	2360M
Budget for year								
Use of equipment, 18%	$1504	$ 375	$ 280	$ 700	$ 113	......	$ 36	......
Rent of floor space	678	66	204	133	137	......	138	......
Supplies	240	50	80	80	5	......	25	......
Purchased machine set	183	......	......	......	......	......	......	$ 183
1000 hrs. at 54c insurance	540	......	......	......	......	......	540	......
1060 hrs. at 54c setting	577	......	577	......	......	......	......	......
2305 hrs. at 54c make-up	1250	......	......	1250	......	......	......	......
850 hrs. at 54c author's	455	......	......	......	......	$ 455	......	......
1080 hrs. at 54c proof	580	......	......	......	......	......	......	580
745 hrs. at 54c lock-up	400	......	......	......	400	......	......	......
198 hrs. at 54c distribution	102	......	2	......	100	......	......	......
510 hrs. at 54c corrections	277	54	58	125	40	......	......	......
970 hrs. at 60c keyboard $582								
600 hrs. at 30c runner...180								
120 hrs. at 60c operator.. 72	834	834	......	......	......	......	......	......
500 hrs. at 30c runner...150								
100 hrs. at 60c operator.. 60	210	......	210	......	......	......	......	......
1200 hrs. at 30c runner...360								
240 hrs. at 60c operator..144	504	......	......	504	......	......	......	......
501 hrs. at 54c miscell...271								
Share of cost keeping....500								
Function of design......200								
Function of control.....800	1771	283	336	477	143	88	296	148
Totals	$10105	$1662	$1747	$3269	$ 938	$ 543	$1035	$ 911
Cost per thousand ems product		$ .69	$3.29	$1.38	$ .40	$ .23	$2.07	$ .38

TABLE 12 *The effect of standardizing the function of design*

		Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proof-reading
Equipment investment.......	$8341	$2080	$1550	$3886	$ 625	......	$ 200	......
Product in actual ems............		2430M	530M	2360M	2360M	2360M	100M	2360M
Budget for year								
Use of equipment, 18%.....	$1504	$ 375	$ 280	$ 700	$ 113	......	$ 36	......
Rent of floor space.........	678	66	204	133	137	......	138	......
Supplies..................	240	50	80	80	5	......	25	......
Purchased machine set......	183	......	......	......	......	......	......	$ 183
500 hrs. at 54c insurance...	270	......	......	......	......	......	270	......
797 hrs. at 54c setting......	433	......	433	......	......	......	......	......
1153 hrs. at 54c make-up....	625	......	......	625	......	......	......	......
425 hrs. at 54c author's....	227	......	......	......	......	$ 227	......	......
1080 hrs. at 54c proof.......	580	......	......	......	......	......	......	580
373 hrs. at 54c lock-up.....	200	......	......	......	200	......	......	......
198 hrs. at 54c distribution..	102	......	2	......	100	......	......	......
510 hrs. at 54c corrections...	277	54	58	125	40	......	......	......
970 hrs. at 60c keyboard$582								
600 hrs. at 30c runner...180								
120 hrs. at 60c operator.. 72	834	834	......	......	......	......	......	......
500 hrs. at 30c runner...150								
100 hrs. at 60c operator.. 60	210	......	210	......	......	......	......	......
1200 hrs. at 30c runner...360								
240 hrs. at 60c operator..144	504	......	......	504	......	......	......	......
Function of design.......	889	60	117	496	47	......	169	......
501 hrs. at 54c miscell..271								
Share of cost keeping....500								
Function of control.....800	1571	283	336	277	143	88	296	148
Totals................	$9327	$1722	$1720	$2940	$ 785	$ 315	$ 934	$ 911
Cost per thousand ems of product...		$ .71	$3.25	$1.24	$ .33	$ .13	$1.94	$ .38

THE LAY-OUT SYSTEM

In general, the work of the lay-out man is to furnish complete instructions for the three operations, setting, make-up and lock-up.

For setting the instructions consist of the copy for the matter to be set marked to show type, measure and spacing.

For make-up the instructions consist of proofs of all type involved, proofs of special material, proofs of cuts, bill of spacing material, and lay-out sheet.

For lock-up the instructions consist of proofs of the pages involved, diagram of lock-up with material given.

The lay-out man also prepares the work tickets for each operation with standard time given.

COPY PREPARATION FOR HAND OR MACHINE SETTING

The instructions for setting consist entirely of copy preparation. To prepare the copy for any job, the lay-out man must determine how the job is to be displayed, what size the page is to be, what type, and the style. This he does by making a rough pencil layout to scale on, say, 8 1-2 x 11 inch sheets of stock (or multiple) square ruled to picas.

Standard copy paper

The copy for any job is first to be arranged in typewritten sheets 8 1-2 by 11 inches. If the copy is furnished typewritten it can be used without transcribing for machine setting. Single spaced typewritten copy that is to be used for display should be transcribed.

If copy as furnished cannot be arranged as above it is transcribed on standard copy paper. This could be an 8 1-2 x 11 inch sheet of yellow chemical manila printed with numbers for 28 lines at left and scale at top and bottom for 53 typewritten characters, with vertical lines for beginning and average ends of lines. This is for standard pica typewriter. The advantage of having 53 typewritten characters to the average line lies in the fact that this line when set in type of any size makes 25 ems. With the lines numbered in the text it is a simple matter to compute the number of ems in such a page of manuscript.

Copy prepared on standard copy paper should be double spaced (one blank line between printed lines).

In preparing copy for display work a new paragraph is started for each line or lines that are to stand alone.

The text

The rough lay-out is developed sufficiently to ascertain the measure of each kind of type used. It may be necessary to carry the lay-out to a complete representation of the finished page by pasting in exact position examples of the selected type face for each item. Proofs of cuts are mounted on the lay-out sheet. If the style of the page is "up to" the office it may be well to get a customer's OK on the complete lay-out before ordering type set. This will prevent changes in style and resetting.

When the rough lay-out is made sufficiently elaborate to determine type, measure and spacing of type, the copy is marked with these three particulars.

The copy is authority for capitalization, punctuation, and spelling. The usual proof-reader's marks are to be used. Thus italic is marked by a single underscore, small caps by a double underscore. Three lines under a lower case letter or word mean caps, a line through a capital means lower case. These marks having to do with the type character used are all made in black on the text of the copy.

Instructions for type, measure, and spacing

Marks showing type to use, measure, and spacing are made in black at left margin opposite the first line of the copy affected. This notation applies to all following lines of copy until a new notation is made.

Type face is indicated by the first symbol consisting of the point size in figures and the face symbol in letters. A suggested list of symbols for all material is given in Table 13.

It will be noticed that in selecting letters for the symbol of any material a mnemonic relation has been secured in almost all cases. This connection of the symbol with the thing symbolized is rather far fetched in a few cases, but still useful in aiding the memory at that. Thus, using A for Cheltenham, we associate A with the initial letter of Antique which in a way identifies Cheltenham as a medium Roman. L is used as the symbol of italic as I, its proper initial, is ruled out of our working alphabet because in use it might be taken for a figure 1. The letter O does not appear in the alphabet for the same reason, because it might be mistaken for the zero sign. J for Initials, Ornaments and Rules is good symbolizing if we mentally label this group "Junk." K for Cuts carries its own justification. Two point leads (U) and one point leads (V) might seem purely arbitrary, but can be considered symbolic if we think of U made up of two vertical

TABLE 13

Symbols for composing room materials

Type faces

A	Cheltenham "Antique"
AL	Cheltenham italic
B	Cheltenham bold
C	Caslon
CL	Caslon italic
H	Other type faces
HB	Bodoni
HC	Cloister old style
HCL	Cloister old style italic
HK	Bookman
HKL	Bookman italic
HS	Scotch roman
HSL	Scotch roman italic
HT	Cloister text
HU	Cheltenham bold outline
HV	Avil

Other material that prints

J	Initials, ornaments, rules
JC	72 point Cloister initials
JD	72 Della Robbia initials
JF	4 point full face rule
JJ	30 point Jenson initials
JHC	Hair line rule centered on 2 point body
JMC	1 point rule centered on 2 point body
JM	1 point full face rule
JMF	1 point rule faced on 2 point body
JT	2 point full face rule
K	Cuts
L	Linotype matter
M	Monotype matter

Make-up material

N	Nonpareil slug
P	Pica slug
Q	Quotations and metal furniture
R	Iron furniture
S	Steel furniture
T	Tie-up slug
U	2 point lead
V	1 point lead

Lock-up material

W	Wooden furniture
X	Quoins
Y	Proving material
Z	Miscellaneous material

lines, and V "coming to one point" at the foot. X for quoins can also be justified on the grounds that a pair of quoins looks something like the letter X. The last two letters are purely arbitrary.

The type face symbol is followed by the measure in picas. Thus, 10C21 means 10 point Caslon set 21 picas measure.

The spacing symbol follows showing arrangement of line in stick. If no spacing symbol follows it is to be set the same as straight matter. Conventions may be adopted as spacing symbols, in addition to ordinary proof-reader's marks, as shown in Table 14.

Copy fitting

For measuring copy and marking it for the machine, the methods given in "Copy Fitting" by the Monotype Company will be found useful.

In using this system the lay-out man can ascertain very accurately the exact space any copy will occupy in any of the type faces available, solid or leaded. Or if the space and type face are determined the measurements will give the exact amount of copy required. Very little figuring is required as all the data appears in concise tables. As an example of the ease with which this system works we can take a simple case where we have, let us say, a typewritten page of manuscript prepared with 53 characters to the line and 28 lines to the page, and lay it out to occupy a neat position on a page 6 x 9 inches over all, no display. The copy, prepared in this standard way, is self measuring, and we know that each line contains 25 ems, or 700 ems for the page of 28 lines. As a tentative measure for the page of type we may select 25 picas and see how deep a page our 700 ems of matter will make in, say, 12 point Caslon, which we find is 11 set. By refer-

TABLE 14

Spacing symbols

[	Begin flush at start of line.
]	End flush at end of line.
©	Center.
$\boxed{3}$	Put in number of picas indicated.
‖	Two vertical lines between two words, start new line.
⌇	Wave vertical line between two words, put in sufficient justifying space to meet other requirements.
|	Vertical line connecting characters in several lines, line up.
$\boxed{\substack{5\\ \text{ems}}}$	Put in number indicated of ems of type being used.
$\boxed{\substack{6\\ \text{pts}}}$	Put in number of points indicated.

ence to the "Table of changing pica measures to ems measures" we note that 25 pica ems measure equals 27 ems 11 set. By reference to the "Table of set ems" we note that 702 ems if set 27 ems wide makes 26 lines which means in this case 26 picas for the depth of the page. As a page 24 x 26 will hardly make a good showing on a page 6 x 9 we now see if the proper proportions can be reached by leading the matter. By reference to another table "Table for changing lines into picas and points," we note that 26 lines of 14 point (12 point leaded) make 30 picas and 4 points. As this will make our page 24 x 30 picas 4 points, we may conclude that this proportion will answer for our purpose and therefore mark the copy to be set in 12 point Caslon leaded, 24 picas measure, with the assurance that it will fit in the space intended. If, however, it were decided not to lead the page but to make the measure narrow enough to extend the proportionate depth of page, the recalculation would be very simple. If we take 21 picas as our tentative measure, we first change this to ems of 11 set, which, a glance at the table shows to be 23 ems, then find that 713 ems of 23 ems measure makes 31 lines, giving our page dimensions 21 x 31 picas of solid 12 point Caslon. As this proportion is practically the proportion of the page 6 x 9 (the "golden oblong" which is half again as deep as it is wide) we are sure to have a good looking page. These figures are exact to a very small percentage of error. The amount of error is shown where 703 ems (from the table) in one case and 713 in the other are taken as against the 700 of the copy. As this error would confine itself entirely to the matter of having the last line of the page (figuring the matter as one paragraph) either short or long, it may be said to be 100 per cent exact. In practice the breaking of paragraphs may affect the measurements to the extent of one line in 50 (2 per cent) but this is so close that make-up could actually proceed on the "copy fitting" measurement, if it were desired, without serious danger of having to alter the setting. As make-up lay-outs are made from proofs of matter already set, the object of "copy fitting" is perfectly accomplished if it sets its measurement within 5 per cent of actual setting.

THE LAY-OUT

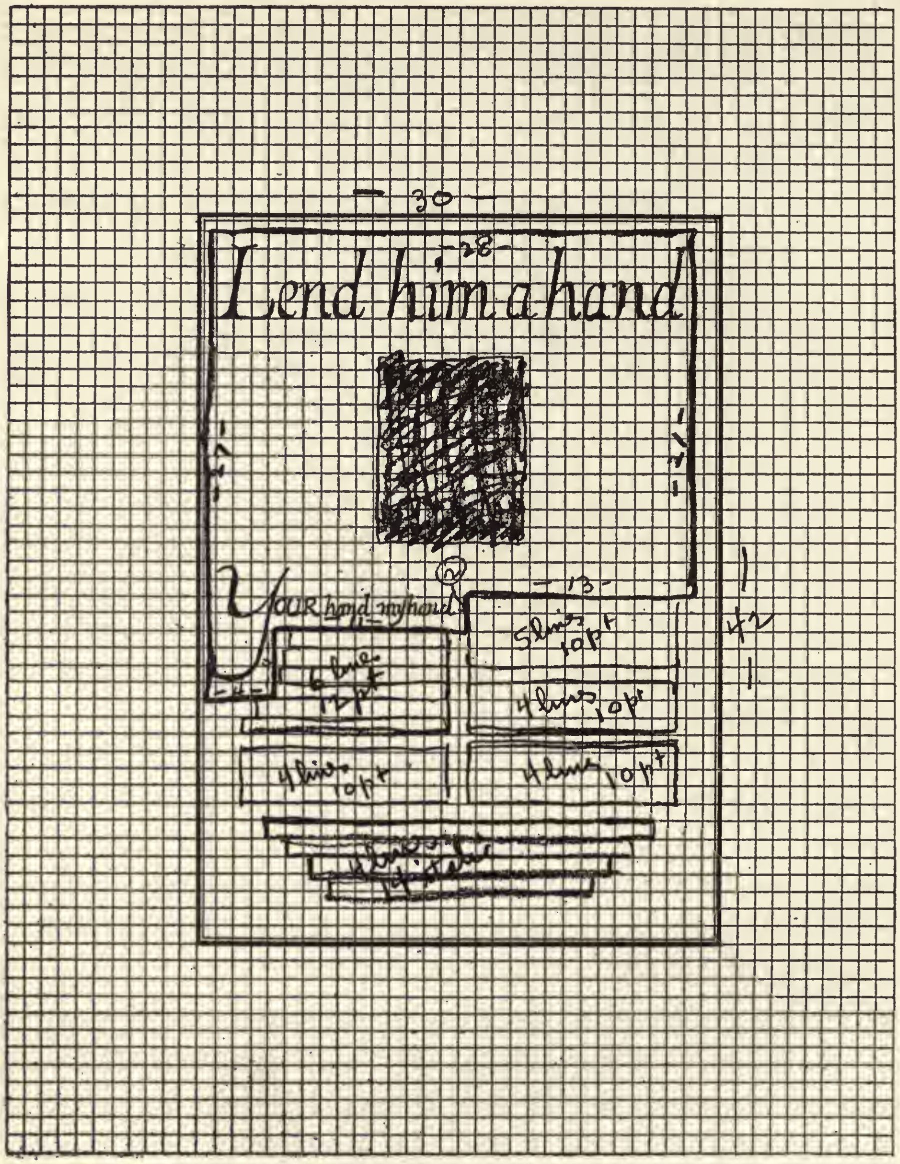
A white proof of corrected matter is cut up and pasted in position on the rough lay-out sheet and also proofs of special material and cuts.

Spacing material is then figured out and marked by symbol on the lay-out sheet. When all spacing material is entered it is listed on "bill of material" sheet.

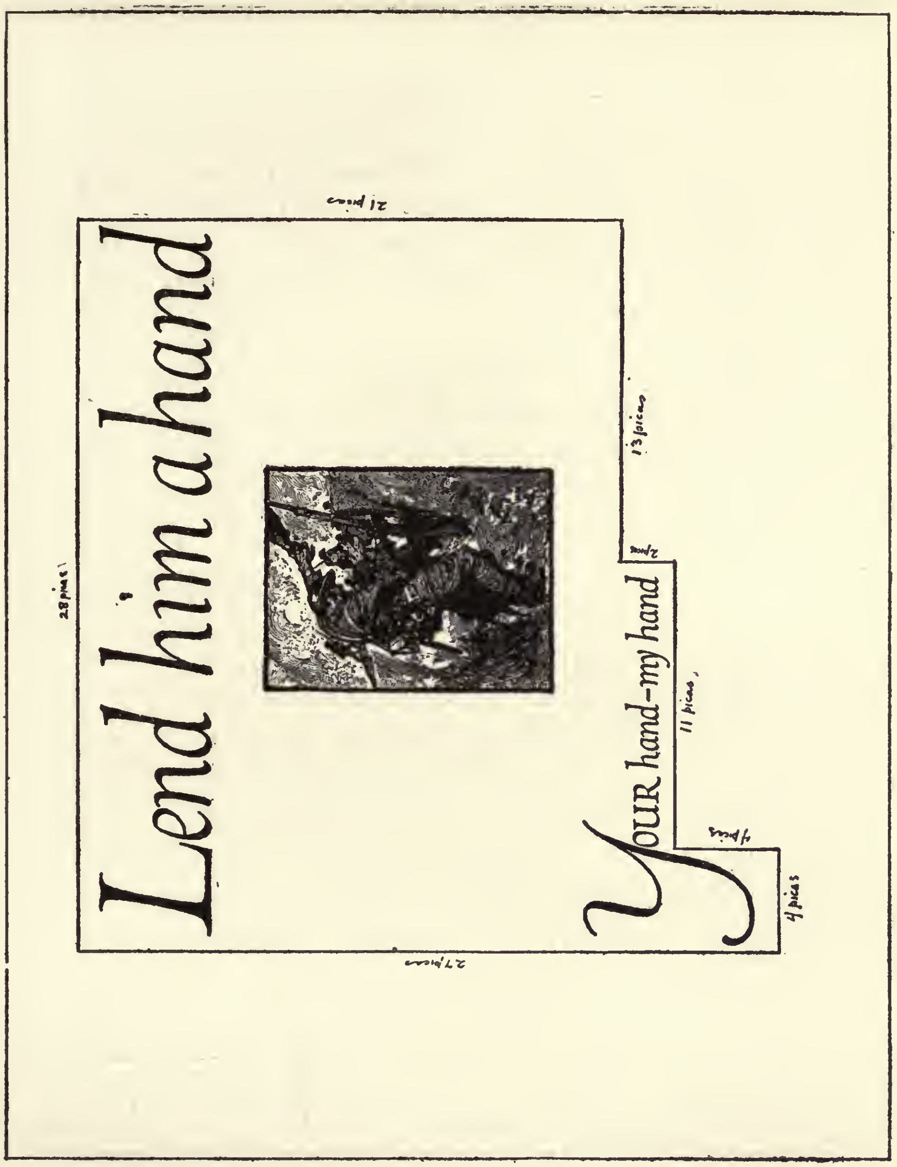
The proofs of all matter involved (on yellow paper), the bill of material, and lay-out sheet constitute the full instructions for make-up.

The make-up man is given the proofs, material list and lay-out as an order to make-up, accompanied by a work card which is used to record his time.

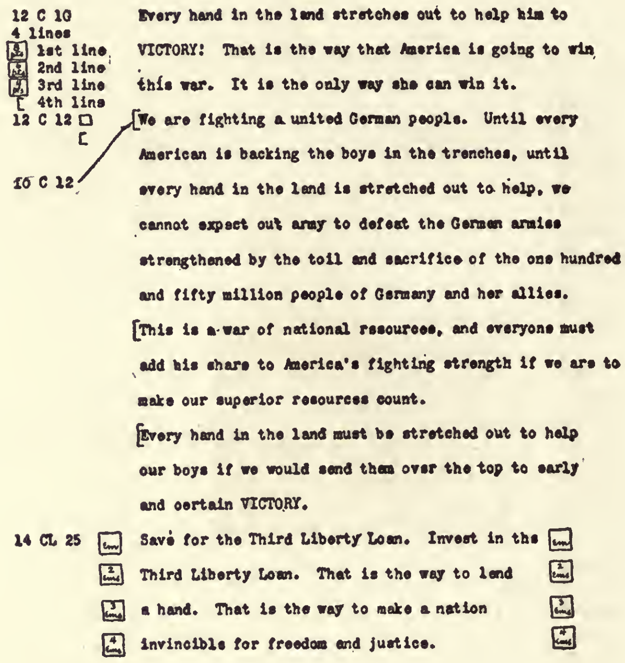
How this can be done in an accurate, systematic way can best be shown by an actual example. In the illustrations that follow a page advertisement is shown in the several steps of production from copy preparation to finished tied up page.



This is the rough preliminary which the lay-out man makes for his own guidance in determining the size of cuts, drawings and type. It is made only for this purpose and does not go out of his hands. Paper ruled in pica squares is convenient to work on.



The drawing for the illustration is carefully marked with a red outline showing the edge of the finished block. All dimensions are given in even picas for the cut as reduced, and agree with the outlined dimensions on the rough lay-out. This prevents waste in justification.



12 C 10
4 lines
1st line
2nd line
3rd line
4th line

Every hand in the land stretches out to help him to VICTORY: That is the way that America is going to win this war. It is the only way she can win it.

12 C 12 ☐

10 C 12

We are fighting a united German people. Until every American is backing the boys in the trenches, until every hand in the land is stretched out to help, we cannot expect out army to defeat the German armies strengthened by the toil and sacrifice of the one hundred and fifty million people of Germany and her allies.

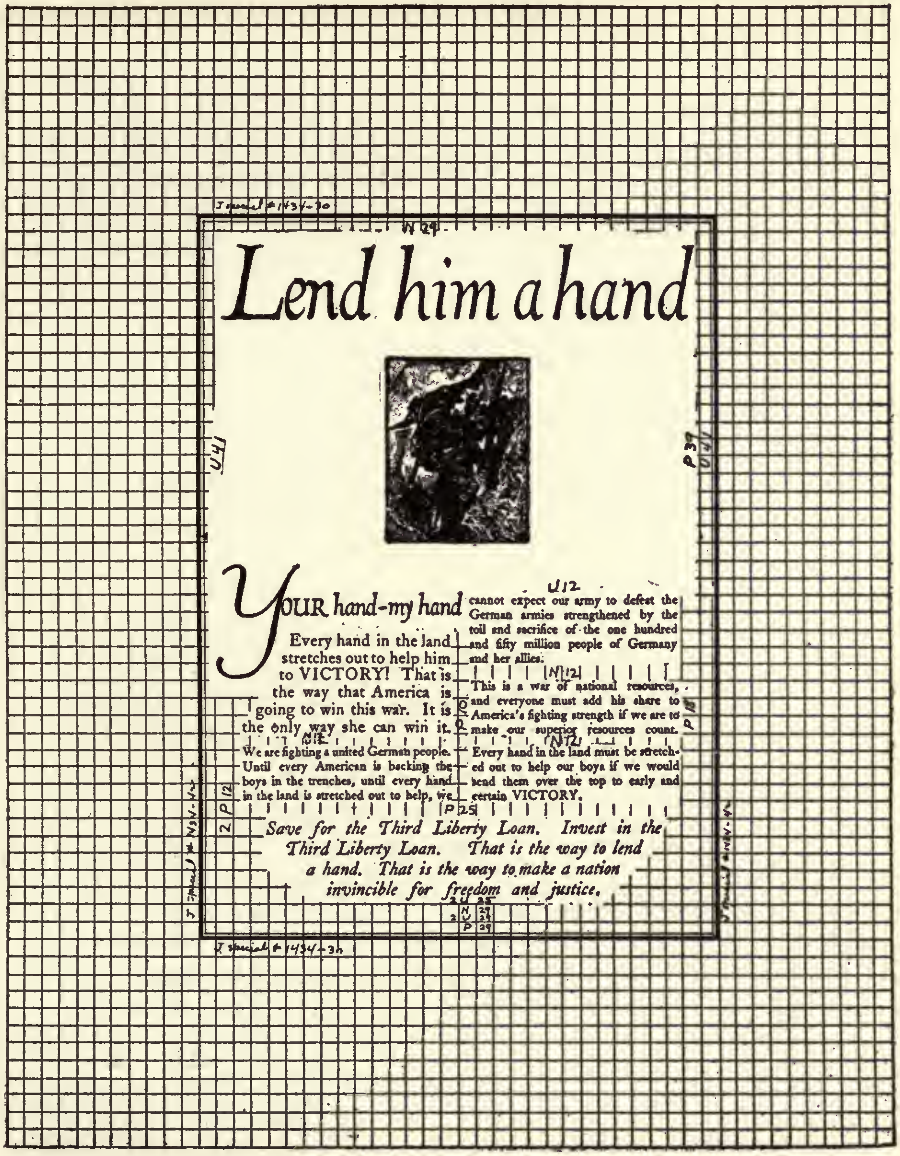
This is a war of national resources, and everyone must add his share to America's fighting strength if we are to make our superior resources count.

Every hand in the land must be stretched out to help our boys if we would send them over the top to early and certain VICTORY.

14 CL 25

em | Save for the Third Liberty Loan. Invest in the | em
2 ems | Third Liberty Loan. That is the way to lend | 2 ems
3 ems | a hand. That is the way to make a nation | 3 ems
4 ems | invincible for freedom and justice. | 4 ems

The copy as prepared for the compositor shows by its symbolic marking the four essential particulars: the text, the type to use, the measure to set the composing stick, and the spacing of the line after it has been set. No questions of any kind are necessary.



Lend him a hand

YOUR hand-my hand

Every hand in the land stretches out to help him to VICTORY! That is the way that America is going to win this war. It is the only way she can win it.

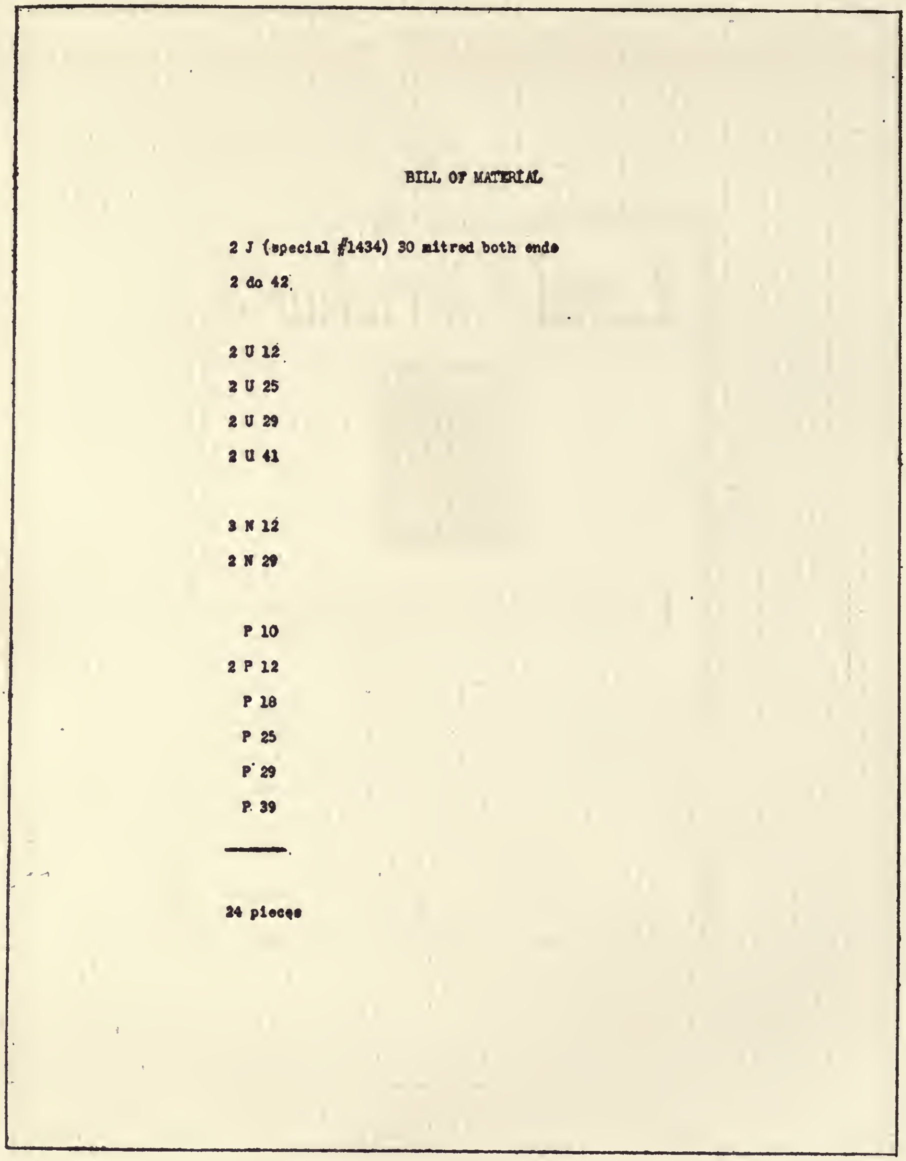
We are fighting a united German people. Until every American is backing the boys in the trenches, until every hand in the land is stretched out to help, we cannot expect our army to defeat the German armies strengthened by the toil and sacrifice of the one hundred and fifty million people of Germany and her allies.

This is a war of national resources, and everyone must add his share to America's fighting strength if we are to make our superior resources count.

Every hand in the land must be stretched out to help our boys if we would send them over the top to early and certain VICTORY.

Save for the Third Liberty Loan. Invest in the Third Liberty Loan. That is the way to lend a hand. That is the way to make a nation invincible for freedom and justice.

When proofs of type and cuts are received the lay-out man pastes them in position on his rough lay-out and figures out the necessary leads, slugs or other material needed to make-up the page. Spacing material is carefully marked by appropriate symbol as shown.



BILL OF MATERIAL

2 J (special #1434) 30 mitred both ends
2 do 42

2 U 12
2 U 25
2 U 29
2 U 41

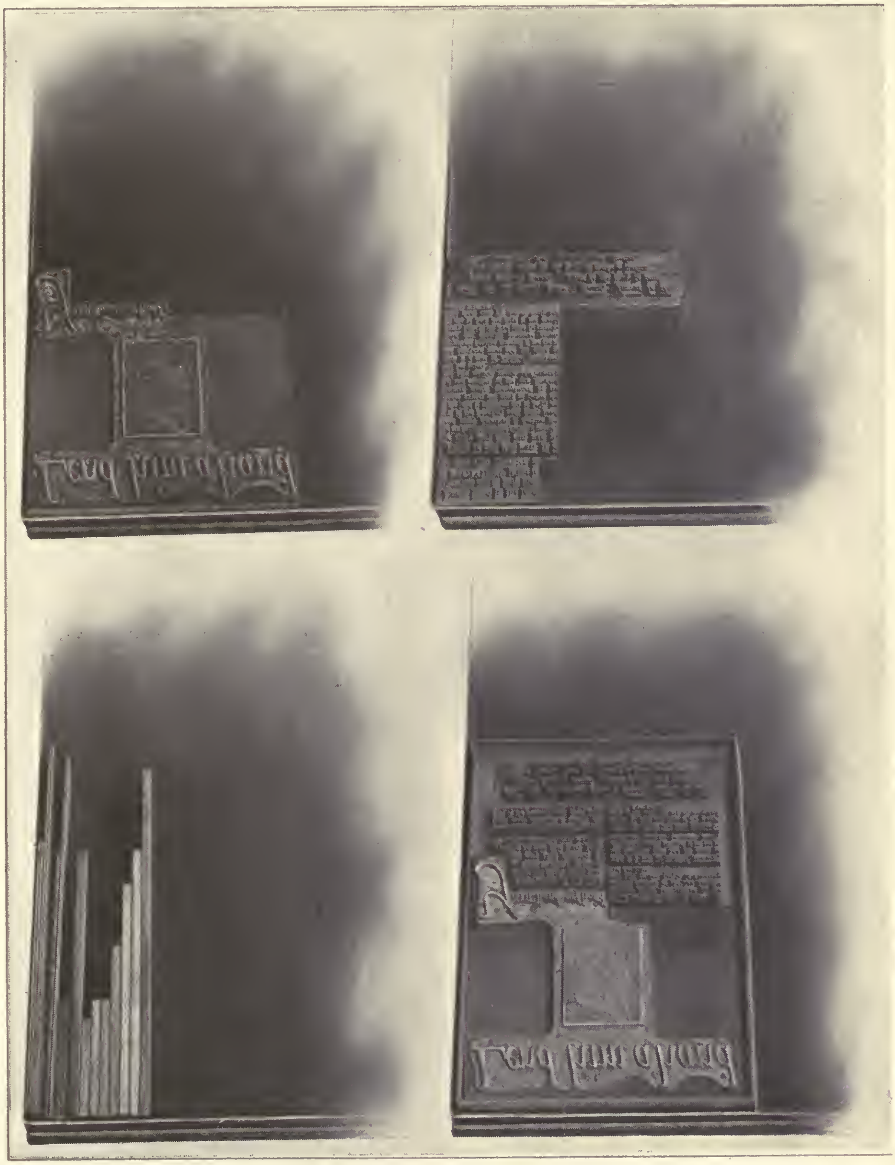
3 N 12
2 N 29

P 10
2 P 12
P 18
P 25
P 29
P 39

---

24 pieces

The bill of material is simply a list of the material needed for the make-up of the page and is figured out from the lay-out sheet. In making up the page the workman gathers together all his material from this list and proceeds to put it together according to the lay-out.



Photographs of the job in various stages. First, the cut as it was received from the engraver and put on a galley for proving. Second, the type matter as set up. Third, the material which has been gathered. Fourth, the made up page ready for OK.

Lend him a hand

YOUR hand–my hand

Every hand in the land stretches out to help him to VICTORY! That is the way that America is going to win this war. It is the only way she can win it.

We are fighting a united German people. Until every American is backing the boys in the trenches, until every hand in the land is stretched out to help, we cannot expect our army to defeat the German armies strengthened by the toil and sacrifice of the one hundred and fifty million people of Germany and her allies.

This is a war of national resources, and everyone must add his share to America's fighting strength if we are to make our superior resources count.

Every hand in the land must be stretched out to help our boys if we would send them over the top to early and certain VICTORY.

Save for the Third Liberty Loan. Invest in the Third Liberty Loan. That is the way to lend a hand. That is the way to make a nation invincible for freedom and justice.

VII-The Function of OPERATION

IN CONSIDERING THE EFFECT of developing the function of operation in the composing room we are dealing with the matter of the actual work of setting, make-up and lock-up, separated from all indirect service such as design, control, proof-reading, distributing type, or looking after the product between operations. We have, in the preceding chapter on design, separated out from the reported cost of operation the designing element. It is necessary, now to separate out any other service elements so that what is left may be regarded as the real cost of operation under present conditions.

SEGREGATING OPERATION

Actually separating the designing and other services from the operation, that is, doing the work in two steps, planning and doing, has this effect, that we can study each step separately and make a much more exact estimate of the time rate for the second step than if the operation contained the planning and equipment and other service items as well.

We shall attempt to find the net operating times in the four items on Table 12, that represent the operating charges for hand setting, make-up lock-up, and insurance work, each on its own merits and check its rate of operation against an estimate. The charges for corrections of these same classes of work will also come into the discussion, for the correction work is simply additional operation due to imperfect work and must appear as part of the final cost of the operation. If corrections were considered a separate service rendered operation, like proof-reading, for instance, or the distribution of type, and so handled in the cost keeping, it would have the result of making operation rates extremely unreliable when applied to any given job. A job, under such conditions, might show a low cost of operation and still be so full of errors that the real cost of the work would be high.

The operation of setting is not complete until the type is set and corrected, and likewise a page is not considered fully made-up until it has been corrected, or a form as completely locked until all danger of having to unlock it is passed.

In our table, insurance work is represented by an item which includes work of several kinds, so this will be considered separately from the general setting, make-up and lock-up.

Proof-reading will be considered separately as a part of the function of comparison, and not as a part of operation.

The operations involved in monotype work are not altered in this estimate of the effect of developing the function of operation, as they are considered net operating rates as they stand.

THE HAND SETTING OPERATION

In the matter of the hand setting of type we note in Table 12 that the net operating charge (with the design element separated out) is 797 hours at 54 cents, or $433, for the year's business of 530M ems. As this item for hand setting was originally separated out from the item which represents the combined wage cost of setting and make-up on the basis of estimating the setting rate at 500 ems per hour, we see our cost figures still follow this figure. In separating the designing element we considered it to be 25 per cent of the total hours given for hand setting. Reducing the number of hours for setting the same product means raising the em rate from 500 ems to 666 ems, which checks with the figures for the year of 797 hours and 530M ems. This simply means that we estimate that a compositor furnished with copy prepared to standard can set on the average 666 ems per hour as against 500 ems per hour if he has to decide on type face, measure to set, and spacing of his matter.

While it is true that, once the functions of design, equipment, control, and comparison are in full working order so that the compositor can absolutely rely on having all of his time exclusively for the setting operation, this rate of 666 ems per hour on the average could probably be improved, we are not now considering this further perfection of the function of operation. What we are after in figuring the effect of the development of the function of operation, at this point is its effect under conditions of average working efficiency, and not under conditions where a wholly new technique is introduced.

We are figuring here that an average workman at 54 cents wages per hour, with copy prepared as outlined in the chapter on design, with a full case of type provided, with definite orders as set forth in the chapter on control, can, without special training, or overworking himself, set 666 ems of any size type (measured actual ems) on the average in an hour. The whole question of operating efficiency above the average, and securing this efficiency by special training and paying a bonus, is not here taken up. This will be considered as a second phase in the development of the function of operation. As we are here considering only the first step in the development of the function of operation, with the object of segregating out everything else and giving it a chance to function alone, we shall not make any change in Table 12 for the operation of hand setting.

For the corrections of hand setting, however, we will make a small change due to the development of the function of operation. In estimating corrections (except for monotype setting) we assumed the corrections time to be one tenth the operating time. It is reasonable to suppose that by separating the designing from the setting, enough more accuracy of operation will be secured so that one tenth of the net operating time will still suffice for correcting. On this basis the corrections time for hand setting is reduced from $58 to $43, a saving of $15.

THE MAKE-UP OPERATION

In considering make-up we have on Table 12 an item of 1153 hours, $625, representing the operation of make-up with the design element separated out.

This item still includes, however, a charge for the adjusting of cuts to fit in the page and the preparation of any special material used in making up, such as cutting and mitering rules. The justification of cuts and the preparation of special material is not part of the function of operation but (as will be shown later) part of the function of equipment. To get the net operation cost of make-up we must estimate how much of the present item of 1153 hours, $625, represents the equipment service and separate it out. Roughly, I should estimate that the equipment service, the time spent on getting cuts in shape for make-up, getting rules cut to the size wanted, and adjusting the material to the job, occupied a third of the time represented by the 1153 hours on Table 12 as make-up. If this estimate can be taken as representing the facts, then the item 1153 hours, $625 should be divided into the item, 787 hours, $425, and 366 hours, $200, for equipment service. This change makes no difference in the total budget for the year as it simply separates the charge and does not eliminate either part.

Since the make-up product is 2360M ems of type matter handled in 787 hours, the em rate is exactly 3M ems per hour. This, of course, figures the entire make-up operation on the basis of the type matter only and really assumes that the amount of leads, slugs, furniture and cuts will run fairly uniform per thousand ems for either machine or hand set matter. This assumption as it stands would not be a safe one to make in actual practice, but will be perfectly safe if it is corrected (as will be pointed out later) by using the measured em and not the actual em as a basis of measuring the type. Thus double price machine matter will automatically double the make-up time allowance, and 36 point type (measured as 12 point face) will automatically increase the make-up time allowance three fold wherever it occurs.

What we are after at this point is an estimate of make-up based on actual ems which we know to be true for the average of a fair number of jobs (no matter how some individual jobs of this number may vary). If the estimated rate, based on actual ems, is true as an average rate we may be sure it will represent a usable rate when the product is considered in terms of measured ems.

Corrections for make-up would show a saving if we figure the corrections as one tenth of the net operating time. This item becomes 79 hours, or $43, as against $125 in Table 12. This means a saving of $82 due to the development of the first step of the function of operation on account of make-up corrections.

THE LOCK-UP OPERATION

For lock-up, the cost of net operation from Table 12, is the wages of 373 hours, or $200, for locking a product represented by 2360M ems.

The actual work of lock-up under the conditions existing when this time report was made no doubt included considerable work which was properly speaking part of the equipment service. Thus, whatever time was spent in justifying pages or cuts so that the form would lift, whatever time was spent in hunting up chases or other material not at hand, and whatever time was spent on relocking because of a change in imposition, should be separated out from the operating lock-up charge and made into an equipment service item which will be dealt with later. As an estimate of this division I will take the figures as follows: equipment service 137 hours, $72, and net lock-up operation 236 hours, $128. This change makes no difference in the total budget.

The net rate of lock-up operation found by dividing the net hours of operation (236) by the year's product (2360M ems of matter locked up) is found to be 10M per hour.

Corrections for lock-up would show a saving. If estimated as one tenth the net operating time then this item becomes 24 hours, or $13, against $40 on Table 12, a saving of $27 due in the matter of lock-up corrections to the development of the first step of the function of operation.

THE INSURANCE WORK

A summary of the operation of setting, make-up and corrections, as involved in the insurance work, figured at the same rates as in the foregoing paragraphs is as follows:

Setting, 100M ems at 666 ems per hour	166 hours
Make-up, 700M ems at 3M ems per hour	233
Corrections, one tenth setting and make-up time	40
Total hours operation	439

As Table 12 shows 500 hours devoted to insurance work, and as this item also includes proof-reading in addition to operation, we will assume that the 61 hours difference between this figure and the total operation hours is proof-reading. Insurance work is therefore changed on the table from $270 to $237 and $33 added to the proof-reading column. This has no effect on the total budget for the year but puts the insurance column on the same operating rate as the work of the rest of the shop.

SUMMARY OF OPERATION COSTS

Summing up the saving due to the development of the function of operation (through the first step) shows a total of $124 due

TABLE 12 *The effect of standardizing the function of design*

		Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proofreading
Equipment investment	$8341	$2080	$1550	$3886	$ 625		$ 200	
Product in actual ems		2430M	530M	2360M	2360M	2360M	100M	2360M
Budget for year								
Use of equipment, 18%	$1504	$ 375	$ 280	$ 700	$ 113		$ 36	
Rent of floor space	678	66	204	133	137		138	
Supplies	240	50	80	80	5		25	
Purchased machine set	183							$ 183
500 hrs. at 54c insurance	270						270	
797 hrs. at 54c setting	433		433					
1153 hrs. at 54c make-up	625			625				
425 hrs. at 54c author's	227					$ 227		
1080 hrs. at 54c proof.	580							580
373 hrs. at 54c lock-up	200				200			
198 hrs. at 54c distribution	102		2		100			
510 hrs. at 54c corrections	277	54	58	125	40			
970 hrs. at 60c keyboard $582 600 hrs. at 30c runner . . . 180 120 hrs. at 60c operator . . 72	834	834						
500 hrs. at 30c runner . . . 150 100 hrs. at 60c operator . . 60	210		210					
1200 hrs. at 30c runner . . . 360 240 hrs. at 60c operator . . 144	504			504				
Function of design	889	60	117	496	47		169	
501 hrs. at 54c miscell. . 271 Share of cost keeping . . . . 500 Function of control 800	1571	283	336	277	143	88	296	148
Totals	$9327	$1722	$1720	$2940	$ 785	$ 315	$ 934	$ 911
Cost per thousand ems of product		$ .71	$3.25	$1.24	$ .33	$ .13	$1.94	$ .38

TABLE 15 *The effect of the first step in standardizing operation*

		Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proof-reading
Equipment investment.......	$8341	$2080	$1550	$3886	$ 625	......	$ 200	......
Product in actual ems.............		2430M	530M	2360M	2360M	2360M	100M	2360M
Budget for year								
Use of equipment, 18%.....	$1504	$ 375	$ 280	$ 700	$ 113	......	$ 36	......
Rent of floor space.........	678	66	204	133	137	......	138	......
Supplies..................	240	50	80	80	5	......	25	......
Purchased machine set......	183	......	......	......	......	......	......	$ 183
366 hrs. at 54c work on cuts.	200	......	......	200	......	......	......	......
137 hrs. at 54c work on cuts.	72	......	......	......	72	......	......	......
500 hrs. at 54c insurance....	270	......	......	......	......	......	237	33
797 hrs. at 54c setting......	433	......	433	......	......	......	......	......
787 hrs. at 54c make-up.....	425	......	......	425	......	......	......	......
425 hrs. at 54c author's.....	227	......	......	......	......	$ 227	......	......
1080 hrs. at 54c proof........	580	......	......	......	......	......	......	580
236 hrs. at 54c lock-up......	128	......	......	......	128	......	......	......
198 hrs. at 54c distribution..	102	......	2	......	100	......	......	......
282 hrs. at 54c corrections...	153	54	43	43	13	......	......	......
970 hrs. at 60c keyboard $582 600 hrs. at 30c runner...180 120 hrs. at 60c operator.. 72	834	834	......	......	......	......	......	......
500 hrs. at 30c runner...150 100 hrs. at 60c operator.. 60	210	......	210	......	......	......	......	......
1200 hrs. at 30c runner...360 240 hrs. at 60c operator..144	504	......	......	504	......	......	......	......
Function of design..........	889	60	117	496	47	......	169	......
501 hrs. at 54c miscell...271 Share of cost keeping....500 Function of control.....800	1571	283	336	277	143	88	296	148
Totals.................	$9203	$1722	$1705	$2858	$ 758	$ 315	$ 901	$ 944
Cost per thousand ems product....		$ .71	$3.20	$1.20	$ .32	$ .13	$1.90	$ .40

entirely to the lowering of the item of corrections. This is noted on Table 15 where all the items so far discussed in the development of the first step of the function of operation are shown. Table 12 is repeated for easy comparison.

THE SECOND STEP IN DEVELOPING OPERATION

Table 15 shows the effect of separating all other functions from operation and leaving the net operating item as a distinct charge representing a definite, measurable, piece of work.

The second step in the development of the function of operation is to take these residue charges for operation, study the particulars of the work in detail and estimate as nearly as we can what efficient cost rates ought to be under intensive development.

STANDARDIZING HAND SETTING

In the case of hand setting the rate arrived at in Table 15 is 666 ems any size type per hour at wages of 54 cents per hour, accurately enough set so that corrections would not require more than 10 per cent additional time. The possible increase in rate of setting over this figure, can only be ascertained by a minute, time-motion- and fatigue-study which will reveal the possible speed of setting under practical conditions with scientific accuracy. When this rate of speed is ascertained it can be secured in actual practice by the special training of the compositor and paying an advance on the hour wage rate. It is probable that the time,- motion- and fatigue-study of hand setting would indicate a practical rate of speed under these conditions of over 1000 ems per hour, with corrections held to within one tenth of another hour. It is probable that a 20 per cent increase in wages would secure the accomplishment of this rate in actual practice, provided the man was properly initiated and trained to the work. If these two estimates of probability were realized in practice, the effect of this second step in the development of the function of operation would be to change the item of 797 hours at 54 cents or $433, for the hand setting operation on Table 15 to 530 hours at 65 cents, or $345, a saving on the year's work (530M ems) of $88; and also the item of corrections from 80 hours at 54 cents, $43, to 53 hours at 54 cents, or $29, a saving of $14.

It is interesting to note that this increase in wage rate per hour of 20 per cent paid for hand setting accomplishes a reduction in the wage piece rate for hand setting from 81.5 cents per thousand to 65 cents per thousand. The $88 saving checks exactly by multiplying the product of 530M ems for the year by this saving in piece rate of 16.5 cents per thousand. The wage rate for corrections remains the same, as this is figured to be done by another workman not on a bonus schedule.

STANDARDIZING MAKE-UP

In the case of make-up, Table 15 gives the rate of 3M ems made-up per hour at 54 cents wages per hour, to a degree of accuracy so that one tenth of another hour will cover corrections.

The probability is that a time,- motion- and fatigue-study would reveal that this rate could be increased to 6M ems per hour with a 20 per cent advance in wages. If this should prove a correct forecast then the effect in cost would be to change the item

787 hours at 54 cents, or $425, to 393 hours at 65 cents or $255, a saving of $170 on the year's budget. Corrections would figure 39 hours at 54 cents or $21 against $43 shown in Table 15, a saving of $22 on the year's budget.

We note that this increase in wage-rate for make-up lowers the piece rate from 18 cents per thousand ems of type handled to 10.8 cents, and that this saving in piece rate of 7.2 cents when applied to the year's product of 2360M ems checks with the $170 saving as shown.

STANDARDIZING LOCK-UP

In the matter of lock-up Table 15 gives the rate at 10M ems locked per hour with 10 per cent of the original time for correction allowance.

A time,- motion- and fatigue-study of this operation would probably indicate a possible increase in rate to 20M per hour with a 20 per cent increase in wages. On this basis the effect of the second step in the development of the function of operation would be to change the item on Table 15 of 236 hours at 54 cents, or $128, to 118 hours at 65 cents, or $77, a saving of $51 for the operation of lock-up on the year's budget. Corrections for lock-up would be changed from 24 hours at 54 cents, or $13, to 12 hours at 54 cents, or $7, a saving of $5 for the year.

We note that the effect of this development of the second step of operation is to lower the wage piece rate for lock-up from 5.4 cents per thousand ems handled to 3.3 cents, a saving of 2.1 cents per thousand ems which, when multiplied by the total product, 2360M ems checks with the saving of $51 as given.

STANDARDIZING THE INSURANCE WORK

If these same operating rates are applied to the insurance work the summary is as follows:

Setting, 100M ems at 65 cents per thousand	$65
Make-up, 700M ems at 10.8 cents per thousand	76
Corrections, 22 hours at 54 cents per hour	12
	$153

Table 15 gives the insurance operating item as $237. Subtracting the above $153, we have a saving of $84 for insurance work due to the second step in the development of the function of operation.

SUMMARY

Summing up these various savings due to the development of the second step in the function of operation we have:

Hand setting	$88
Hand setting corrections	14
Make-up	170
Make-up corrections	22
Lock-up	51
Lock-up corrections	5
Insurance work	84
	$434

These figures are set forth in detail in Table 16. Table 15 is repeated for easy comparison.

TABLE 15 *The effect of the first step in standardizing operation*

		Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proof-reading
Equipment investment........	$8341	$2080	$1550	$3886	$ 625	......	$ 200	......
Product in actual ems.............		2430M	530M	2360M	2360M	2360M	100M	2360M
Budget for year								
Use of equipment, 18%.....	$1504	$ 375	$ 280	$ 700	$ 113	......	$ 36	......
Rent of floor space.........	678	66	204	133	137	......	138	......
Supplies..................	240	50	80	80	5	......	25	......
Purchased machine set......	183	......	......	......	......	......	......	$ 183
366 hrs. at 54c work on cuts.	200	......	......	200	......	......	......	......
137 hrs. at 54c work on cuts.	72	......	......	......	72	......	......	......
500 hrs. at 54c insurance....	270	......	......	......	......	......	237	33
797 hrs. at 54c setting......	433	......	433	......	......	......	......	......
787 hrs. at 54c make-up.....	425	......	......	425	......	......	......	......
425 hrs. at 54c author's.....	227	......	......	......	......	$ 227	......	......
1080 hrs. at 54c proof........	580	......	......	......	......	......	......	580
236 hrs. at 54c lock-up......	128	......	......	......	128	......	......	......
198 hrs. at 54c distribution..	102	......	2	......	100	......	......	......
282 hrs. at 54c corrections...	153	54	43	43	13	......	......	......
970 hrs. at 60c keyboard $582								
600 hrs. at 30c runner...180								
120 hrs. at 60c operator.. 72	834	834	......	......	......	......	......	......
500 hrs. at 30c runner...150								
100 hrs. at 60c operator.. 60	210	......	210	......	......	......	......	......
1200 hrs. at 30c runner...360								
240 hrs. at 60c operator..144	504	......	......	504	......	......	......	......
Function of design..........	889	60	117	496	47	......	169	......
501 hrs. at 54c miscell...271								
Share of cost keeping....500								
Function of control.....800	1571	283	336	277	143	88	296	148
Totals.................	$9203	$1722	$1705	$2858	$ 758	$ 315	$ 901	$ 944
Cost per thousand ems product.....		$ .71	$3.20	$1.20	$ .32	$ .13	$1.90	$ .40

TABLE 16 *The effect of the second step in standardizing operation*

		Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Insurance work	Proof-reading
Equipment investment.......	$8341	$2080	$1550	$3886	$ 625	......	$ 200	......
Product in actual ems.............		2430M	530M	2360M	2360M	2360M	100M	2360M
Budget for year								
Use of equipment, 18%.....	$1504	$ 375	$ 280	$ 700	$ 113	......	$ 36	......
Rent of floor space.........	678	66	204	133	137	......	138	......
Supplies..................	240	50	80	80	5	......	25	......
Purchased machine set......	183	......	......	......	......	......	......	$ 183
366 hrs. at 54c work on cuts..	200	......	......	200	......	......	......	......
137 hrs. at 54c work on cuts..	72	......	......	......	72	......	......	......
Insurance work............	186	......	......	......	......	......	153	33
530 hrs. at 65c setting......	345	......	345	......	......	......	......	......
393 hrs. at 65c make-up.....	255	......	......	255	......	......	......	......
425 hrs. at 54c author's.....	227	......	......	......	......	$ 227	......	......
1080 hrs. at 54c proof........	580	......	......	......	......	......	......	580
118 hrs. at 65c lock-up......	77	......	......	......	77	......	......	......
198 hrs. at 54c distribution..	102	......	2	......	100	......	......	......
204 hrs. at 54c corrections...	111	54	29	21	7	......	......	......
970 hrs. at 60c keyboard $582								
600 hrs. at 30c runner...180								
120 hrs. at 60c operator.. 72	834	834	......	......	......	......	......	......
500 hrs. at 30c runner...150								
100 hrs. at 60c operator.. 60	210	......	210	......	......	......	......	......
1200 hrs. at 30c runner...360								
240 hrs. at 60c operator..144	504	......	......	504	......	......	......	......
Function of design..........	889	60	117	496	47	......	169	......
501 hrs. at 54c miscell...271								
Share of cost keeping....500								
Function of control.....800	1571	283	336	277	143	88	296	148
Totals..................	$8768	$1722	$1603	$2666	$ 701	$ 315	$ 817	$ 944
Cost per thousand ems product.....		$ .71	$3.01	$1.12	$ .30	$ .13	$1.77	$ .40

VIII-The Function of EQUIPMENT

WE HAVE ALREADY DISCUSSED in Chapters II and III the physical equipment for machine setting, hand setting and make-up, but as this is only one phase of what is covered in the function of equipment we shall take up now the discussion of this function as a whole. The function of equipment has to do primarily with the equipment for operation, but it also covers whatever equipment is needed for the exercise of other functions, as well as that equipment which is used by the service work of the equipment function itself.

The function of equipment embraces four classes of charges which are as follows: 1, the capital charge, or investment charge, consisting of depreciation, interest, insurance and taxes on the equipment; 2, the rent charge for floor space, including light and heat; 3, supplies such as power, oil, paper, etc.; and 4, wages paid for such service as proving, handling products between operations, distribution of type and other material.

The first three groups of equipment function, charges, namely, capital charges, rent of floor space, and supplies, are given in Table 16 in the first three items of the list of expenses.

The fourth group of equipment function charges, the service element, is made up of the items from the pay roll of 198 hours, $102, distribution; the 366 hours, $200, for justifying work on cuts formerly included in make-up operation; and the 137 hours, $72, for justifying work on cuts and other material formerly included in lock-up.

MAKING ROUTINE OPERATIONS OF THE INSURANCE WORK

At this point it is desirable to change the insurance work item in the list of operations or groups of work shown in Table 16. We have noticed in the preceding chapter that the insurance work has entirely lost its characteristics as a separate class of work, and that the rates used to ascertain its cost are the same as the regular rates for machine setting, hand setting and make-up. For this reason the 100M ems of hand setting product are transferred to the hand setting column with the amount that represents the setting and correction operation costs. Likewise the make-up cost is transferred to the make-up column and 800M ems of make-up added to the product item. The equipment items are transferred to the make-up column for the present, subject to later revision. The item in the insurance work column for the function of design, $169, is made up of $22, representing the copy preparation for 100M ems of hand set matter at 22 cents per thousand, and $147 representing lay-out for the make-up of 700M ems of matter at 21 cents per thousand. (See Chapter VI on design.) These two items are transferred to the hand setting and make-up columns. The item of $296, the insurance work share of the otherwise undistributed "overhead" is temporarily transferred to the make-up column to be adjusted later. Thus the insurance column may be eliminated from the budget as a separate class of work. This revision, which does not change the total of the budget, is shown in Table 17.

THE BUDGET BY FUNCTIONS AND DEPARTMENTS

It will be noticed in Table 17 that all equipment investment is lumped together and its use charge apportioned to the four classes of work, machine setting, hand setting, make-up and lock-up. Floor space rental and supplies are similarly apportioned. Equipment services are apportioned as they apply. That is to say, the entire equipment expense of all the functions is distributed directly to the four classes of operation.

For an exact analysis of the function of equipment and its expense it is desirable to treat these items in a somewhat different way. The investment in equipment for operation should be considered separately from investment in equipment for design, control, comparison or equipment service. The use charge for operating equipment can be charged directly to the different operations, the use charge for the equipment for other functions should be charged to the cost of the function and allotted to the different operations with the total charge for that function.

Also in an exact analysis of the function of equipment a fifth group of charges should be considered. This is the matter of stores, material purchased and used in the process of manufacture and charged to the customer as part of the job. Stores include raw material and worked material, and in relation to the composing room, take the form of monotype metal, cast type, and cuts.

TABLE 17 *Simplification of Table 16*

			Machine setting	Hand setting	Make-up	Lock-up	Author's changes	Proof-reading
Equipment investment		$8341	$2080	$1550	$4086	$ 625		
Product in actual ems			2430M	630M	3060M	2360M	2360M	2360M
Budget for the year								
Use of equipment, 18%		$1504	$ 375	$ 280	$ 736	$ 113		
Rent of floor space		678	66	204	271	137		
Supplies		240	50	80	105	5		
Purchased machine set		183						$ 183
366 hrs. at 54c work on cuts		200			200			
137 hrs. at 54c work on cuts		72				72		
Insurance, proof-reading		33						33
631 hrs at 65c setting		410		410				
509 hrs. at 65c make-up		331			331			
425 hrs. at 54c author's		227					$ 227	
1080 hrs. at 54c proof		580						580
118 hrs. at 65c lock-up		77				77		
198 hrs. at 54c distribution		102		2		100		
226 hrs. at 54c corrections		123	54	34	28	7		
970 hrs. at 60c keyboard	$582							
600 hrs. at 30c runner	180							
120 hrs. at 60c operator	72	834	834					
500 hrs. at 30c runner	150							
100 hrs. at 60c operator	60	210		210				
1200 hrs. at 30c runner	360							
240 hrs. at 60c operator	144	504			504			
Function of design		889	60	139	643	47		
501 hrs. at 54c miscell.	271							
Share of cost keeping	500							
Function of control	800	1571	283	336	573	143	88	148
Totals		$8768	$1722	$1695	$3391	$ 701	$ 315	$ 944
Cost per thousand ems product			$ .71	$2.70	$1.10	$ .30	$ .13	$ .40

DEPARTMENTS OF OPERATION

For the purpose of a clear presentation of the whole work of the composing room it is desirable to divide the operation which we have up to this time called machine setting into the operations of keyboard work and composition casting, and introduce the two stores accounts of type making and cuts, as departments of composing room work.

So far in our discussion the monotype has been considered simply as setting the matter formerly purchased as machine composition (and part of the insurance work) and as casting the type and material which were required by the hand setting and make-up operations. Having figured out the effect on cost along these lines, we may now consider the monotype in the light of a manufacturing department and arrange to find the cost of keyboard work apart from the casting of composition (so that if it is desired to sell a double casting from the same ribbon it can be done without a change in cost system) and the cost of casting any amount of type, leads, slugs and rules (without reference to the restricted use in our own setting and make-up work). The work of the monotype, then, becomes part of the function of operation, casting type as well as machine setting, and the equipment function for the composing room must include, besides the item of monotype equipment for operation, an item for monotype metal, a special class of stores handled in the type casting work.

The work on cuts which may involve the whole process of blocking (purchasing the cuts unmounted) will be part of the function of operation, while equipment investment for this operation, rent of floor space, equipment services and stores (the purchase of the cuts in an unfinished state) will be part of the function of equipment.

The column devoted to author's changes we have seen has been left to represent simply that portion of work which may be said to alter the product without adding to it. This item is equivalent to time work, that is, work which must be based on a time record, for the product will not of itself show the amount of work by any physical measure. It may be desirable to sell proofreading or lay-out service separate from any measured product, in which case it can be handled easily if we regard it as time work, and make provision for a time work column in our cost budget. Author's changes then can be changed to time work so as to include any other work besides author's changes that it may be desirable to charge out as time work.

We have, then, the following classes of product for the composing room:

Monotype keyboard work
Composition casting
Type, rule, lead, and slug making
Hand setting
Make-up
Lock-up
Time work
Cuts

OPERATION EQUIPMENT

Let us take up first the matter of actual charges in connection with the function of equipment, that is, the capital or investment charges for the operating equipment including depreciation, interest, insurance and taxes.

The items representing equipment investment for the different operations can be definitely given by referring to Chapters II and III where type equipment and the monotype are considered, and providing for the subdivision and modification of these items.

In the former chapters we were considering equipment to find the most economic selection. We found a serious condition in that the type supply and the demands upon it were so poorly related that a large proportion of the actual type in the cases was pure wasted investment. A schedule for type equipment on the basis of foundry type was then made. The monotype adds a new feature in the non-distribution system. It is our purpose now to set forth the standard itemized equipment for each department.

Monotype keyboard work

The equipment for the keyboard operation inventories, new at list prices for separate units and not discounted for combination in standard equipment, as follows:

Style D keyboard	$650
Electric light for reading scale . . .	20
Automatic repeater	75
25 spools for paper, at $1.00	25
	$770

Composition casting and type making

The balance of the monotype equipment used partly for composition casting and partly for type making may be inventoried as follows:

	Both	Composition casting	Type making
Type and rule caster without molds or motor	$1400.00	....	....
Composing machine addition to above	....	$1200.00	....
Display type attachment	....	....	$ 150.00
Lead and rule mold attachment	....	....	25.00
Automatic cutter	....	....	225.00
Furnace, capacity 1200 pounds	100.00	....	....
Water cooled molds	45.00	....	....
Ladle, skimmer, cleaning rod	6.75	....	....
Eight complete fonts composition matrices, complete in case (225 characters each) at $60	....	480.00	....
Miscellaneous composition matrices	....	25.00	....
6, 8, 10, and 12 point composition molds	....	600.00	....
30 fonts (72 characters each) display matrices	....	....	432.00
Miscellaneous display matrices	....	....	25.00
10 rule matrices	....	....	30.00
Sort matrix holder for composition matrices	....	....	9.50
Sort matrix holder for display matrices	....	....	16.00
2 sorts casting molds	....	....	350.00
2 and 6 point lead and rule molds	....	....	400.00
Tie-up slug mold	....	....	250.00
7 normal wedges for composition	....	52.50	....
7 justifying scales	....	10.50	....
Motor for caster	90.00	....	....
Compressor motor	....	60.00	....
	$1641.75	$2428.00	$1912.50

The above monotype equipment for composition casting and type making totals $5982.25 at list prices, which with the $770 for the keyboard department, makes $6752.25 as the list price for the complete monotype equipment. In purchasing this equipment, however, as the standard monotype equipment number 1, with various additions, the total would inventorv as follows:

Standard monotype equipment No. 1 with electric light and repeater units	$4070.00
One 2 point and one 6 point lead and rule molds at $200	400.00
One 12 point tie-up slug mold	250.00
Automatic cutter and operating attachment	250.00
Four extra composition matrices with cases at $60	240.00
30 fonts display matrices at $14.40	432.00
10 rule matrices at $3.00	30.00
Miscellaneous composition and display matrices	50.00
Two motors	150.00
Furnace, molds and tools	151.75
Three extra wedges at $7.50	22.50
Three extra scales at $1.50	4.50
Thirteen extra paper spools	13.00
	$6063.75

This shows a saving in purchase price of $688.50 for buying in standard units of equipment.

To ascertain the net investment in monotype equipment for each of the two departments, composition casting and type making, we may deduct this $688.50 from the item $1641.75 representing the list price of equipment used jointly by both departments and dividing the remainder ($953.25) equally between the two.

This gives the monotype investment in composition casting as $2905 and type making as $2389.

The type making department has a further investment charge for equipment in the storage system for type, rules, leads and slugs, which it produces, and the amount of metal needed, in excess of the actual composing room supply, to enable the department to cast fairly long runs and store the product ahead of requirements.

The storage system consists of 500 individual galleys 8 3-4 x 13 inches in five cabinets, at $50 each or $250. Two thousand pounds of metal is estimated to be needed for advance casting and storage, which at 15 cents a pound figures $300.

The total investment for type making, then, is $2389 in monotype equipment, $250 storage system, and $300 in metal, or $2939.

The composition casting department equipment has a further investment in metal. Enough metal must be provided for this department to allow for casting composition during the period that its product is in use. If the composing room makes a twenty-day "turn over" of the jobs involving composition casting, then a twenty day's supply of metal will be ample for this equipment charge. One hundred pounds a day, or two thousand pounds in all, will be a fair estimate for this item, and this will allow for the possible diversion of some metal in permanent standing matter.

It is not desirable to make a separate account of the cost of keeping matter standing in the composing room as long as the total metal involved for this purpose does not exceed a thousand pounds. Since the actual cost of keeping a thousand pounds of metal standing for a year, including the use of the metal and use of the storage galley equipment, cannot exceed $50, or five cents a pound, this small charge can properly be added to the cost charges of the different departments involved, composition casting, type making, hand setting, and make-up. The amount is so small that it cannot be said appreciably to affect the cost rates for the product of any of these departments. If, however, business should develop along such lines that the standing matter storage should run into several thousand pounds, then standing matter might become a separate productive item and be charged with its exact cost.

The total equipment for composition casting will be the $2905 representing the share in monotype equipment and 2000 pounds of metal at 15 cents, or $300, or $3205 in all.

Hand setting

The equipment for the hand setting department consists of the following inventory:

Foundry type, 6 styles in 42, 48, 60 and 72 point sizes each, 25 pounds with spaces and quads, total 600 pounds at 60 cents . . .	$ 360
Special fonts foundry type, 14 fonts 25 pounds each, including spaces and quads, 350 pounds at 60 cents	210
Monotype type metal for casting two 25 pound fonts each of 6 styles in 9 sizes (108 cases) and 2 extra cases each of 6 fonts (12 cases) total 120 cases 25 pounds each (including spaces and quads) 3000 pounds metal at 15 cents	450
200 pounds metal, for casting leads and slugs, at 15 cents . . .	30
158 cases at $1.00	158
Four stands (capacity 192 cases) with 2 working tops and place for leads and slugs	150
500 pounds metal, allowance for standing matter, at 15 cents . .	75
Miscellaneous tools, composition sticks, setting rules	25
	$1458

Make-up

Make-up is represented by an equipment of $1116 after deducting the share of the monotype. According to the present inventory this $1116 is made up of the following groups of equipment:

Galleys	$ 302.59
Reglet	9.02
Letter boards	55.48
Reglet case	11.00
Lead and slug rack	18.00
Galley cabinet	23.00
Case stands and banks	181.25
Work bench and vise	10.00
Case wood furniture	6.00
Galley cabinet	75.00
Periods, commas, braces, dashes, rule, etc., steel rule, etc.	115.27
Superintendent's desk	91.10
Rule cutter, proof press, etc.	196.95
Brass circles	21.34
	$1116.00

An inventory of equipment needed for the make-up department under standard conditions is suggested as follows:

1500 pounds metal for casting 500 pounds each of 2 point leads, 6 point slugs and 12 point slugs, at 15 cents	$225
500 pounds metal for casting rule, at 15 cents	75
100 pounds metal for casting borders, at 15 cents	15
500 pounds metal, allowance for standing matter, at 15 cents	75
Two working tops for stands	50
Brass rule, steel rules, etc.	100

Materials cabinets	100
Special insurance equipment, stone, racks, chases, trucks	150
Miscellaneous tools	25
	$815

It will be noticed that very little of the present equipment for make-up is available for the standard equipment. Some of it, however, can be utilized in other departments.

Lock-up

The lock-up inventory of $625 represents the equipment for this department without change, although it may be desirable to alter the exact inventory somewhat in actual practice.

Time work

For time work we figure no special equipment, as whatever equipment is used for this work is already provided for in other departments.

Cuts

For the cut department we may make an inventory of equipment as follows:

Four cut file units for 200 cuts each	$ 100
Miller saw-trimmer, complete with motor and attachments	600
Patent bases, hooks, catches, etc., for mounting cuts	250
Work bench, vise, small tools, etc.	50
	$1000

Summary

This completes the equipment investment for operation and may be summarized as follows:

Monotype keyboard	$ 770
Composition casting	3205
Type making	2939
Hand setting	1454
Make-up	815
Lock-up	625
Time work	none
Cuts	1000
	$10808

OPERATING EQUIPMENT USE COST

In order to get a charge against each operative department for the use of its equipment for the year we may take a flat rate of 18 per cent on the investment value, 10 per cent for depreciation, 6 per cent interest, 2 per cent taxes and insurance. As a matter of fact the depreciation item is not uniform for all items of equipment here considered, but the variation is not material. In the hand setting department, for instance, the large sizes of type will actually depreciate much faster than the metal investment for casting type, but a flat 10 per cent on all this equipment will cover the case easily.

The equipment use charge may be given, then, as follows:

Monotype keyboard	$ 139
Composition casting	580
Type making	530
Hand setting	262
Make-up	147
Lock-up	113
Time work	none
Cuts	180
	$ 1951

EQUIPMENT FOR OTHER FUNCTIONS

In addition to equipment for operation as already discussed, we have special equipment for each of the other four functions. The equipment for these other functions will not be subdivided among the eight operative departments directly, but its use cost will be charged to each department along with the labor charge for each of the functions.

Equipment for equipment service

Proving and handling the product between operations will take an equipment which may be inventoried as follows:

Proof press and accessories	$160
300 steel galleys for storing standing matter	160
Cabinet for same	75
300 steel galleys for handling product between operations, with special cabinet	200
Stone and large galleys	100
Miscellaneous tables and small tools	55
	$750

The use cost of the above equipment, figured at 18 per cent of its investment value, is $135 for the year.

Equipment for control

The capital investment for the function of control consists of the superintendent's desk, the mechanism of the routing system, a file cabinet for books, table, and two chairs. An estimate of $100 worth of equipment seems ample for this item. The use cost of this equipment at 18 per cent is $18, which will be the first item of expense for the function of control.

Equipment for design

For the exercise of the function of design the equipment necessary consists of two desks, a table, file cabinet, three chairs, lay-out instruments of measurement, a typewriter, and reference books. Two hundred dollars would probably be a fair estimate of cost and the use charge at 18 per cent of this will be $36 for the year.

Equipment for comparison

We will anticipate the discussion of the function of comparison by estimating its necessary equipment investment to be $100, which, at 18 per cent shows a use cost of $18.

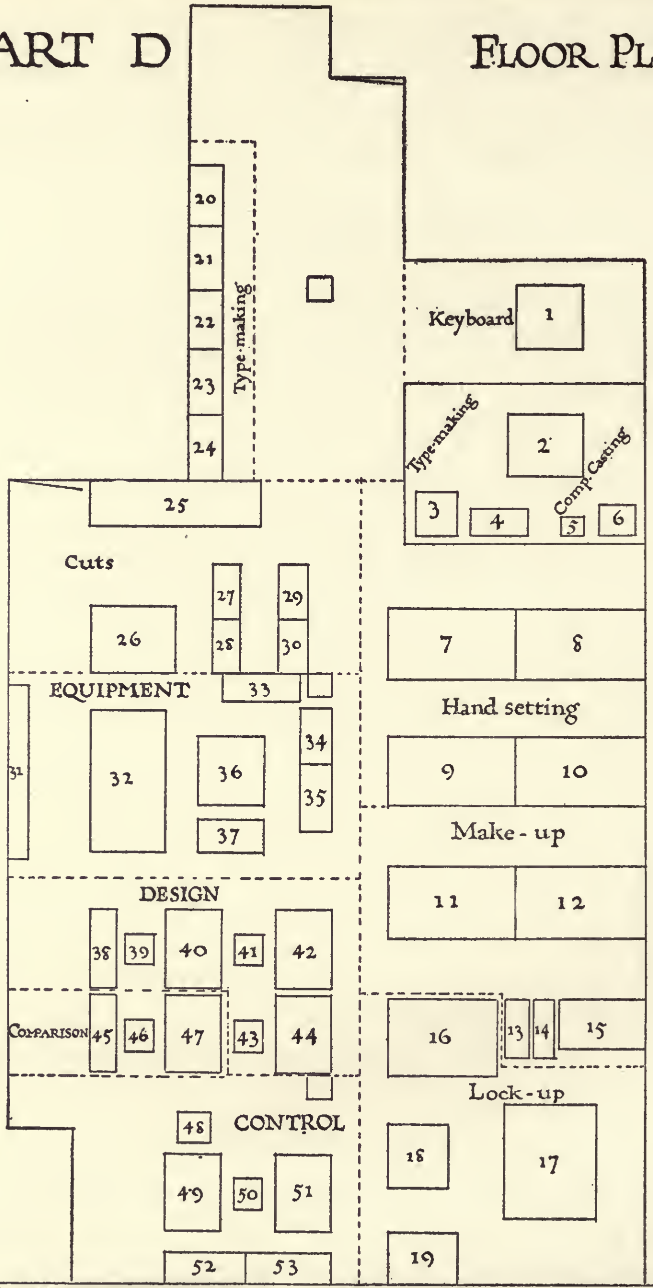
RENT FOR FLOOR SPACE

To ascertain the floor space occupied by each of the operative departments as well as that required by each of the other four functions, it is necessary to lay out the shop in a practical manner and then measure the different areas.

Chart E is submitted as a suggested arrangement which will be discussed in detail later.

Summing up the floor areas shown on the chart as occupied by the different operations and figuring 66 cents a foot to cover rent, light, heat, and janitor service, we have the following charges for the rent service of the function of equipment:

CHART D FLOOR PLAN



KEY TO FLOOR PLAN

Keyboard

1 Monotype keyboard

Composition casting and type making

2 Monotype caster
3 Furnace
4 Refining molds
5 Motor
6 Compressor

Hand setting

7 Type stand
8 Type stand
9 Type stand
10 Type stand

Make-up

11 Make-up materials
12 Make-up materials
13 Insurance form truck
14 Insurance form truck
15 Insurance materials

Lock-up

16 Stone
17 Stone
18 Lock-up materials
19 Form rack

Type making

20 Galley cabinet
21 Galley cabinet
22 Galley cabinet
23 Galley cabinet
24 Galley cabinet

Cuts

25 Saw trimmer
26 Work bench
27 Cut file
28 Cut file
29 Cut file
30 Cut file

Equipment function

31 Standing matter
32 Stone
33 Galley cabinet
34 Galley cabinet
35 Galley cabinet
36 Proof press
37 Proof paper rack

Design function

38 File
39 Chair
40 Desk
41 Chair
42 Desk
43 Chair
44 Desk

Comparison function

45 File
46 Chair
47 Proof-reader's desk

Control function

48 Chair
49 Table
50 Chair
51 Desk
52 File
53 Plan board

	Feet	Rent
Monotype keyboard	66	$ 44
Composition casting	92	61
Type making	44	29
Hand setting	150	99
Make-up	168	111
Lock-up	144	95
Time work	none	none
Cuts	153	101
	817	$540

Floor areas and rental charges for the other four functions are as follows:

	Feet	Rent
For equipment service	170	$112
For design	130	86
For comparison	40	26
For control	132	87
	472	$311

Each of these rental charges for the four different functions will be included in the total charges for the function and distributed to the operating department.

The total floor area for operation and the other functions for the composing room is 1289 feet with a rental of $851.

SUPPLY CHARGES

For the supplies for each of the eight departments of the composing room we can make the following estimates:

Monotype keyboard

The compressed air supply of which the keyboard needs a small share is charged entirely to the caster and hence not included in supplies incurred by the keyboard.

The paper ribbon supply, however, is charged entirely to the keyboard department, and this amounts to, say, $25 a year. No other supplies which amount to an appreciable sum are required by this department.

Composition casting

The caster charge for power, gas and oil when operating on composition casting is figured at $50.

Type making

The caster charge for power, gas and oil, when operating on type making is figured at $50.

Hand setting

Supplies for hand setting are estimated at $10 for the year.

Make-up

An allowance of $10 mainly for tie-up string is made for make-up.

Lock-up

An allowance of $10 for the lock-up supplies is made.

Time work

An allowance of $10 for time work supplies is made.

Cuts

An allowance of $25 for tacks, glue, solder, saw blades, etc., is made for the cut department.

This sums up $190 for supplies for the composing room operation for the year.

In addition to these supplies we must include supplies for each of the other four functions as follows:

Supplies for equipment service

Proof paper, ink, metal cleaner, and gas for refining metal may be estimated to total $50.

Supplies for control

These consist of such printed forms as may be used, amounting, say, to $25 for the year.

Supplies for design

Printed forms, samples of type styles, copy paper, lay-out paper, paste, typewriter supplies, etc., will amount to say $50 for the year.

Supplies for comparison

Cost system blanks, and other statistical records used for the composing room will figure, say, $50 for the year.

EQUIPMENT SERVICE

Having considered the capital charges, the rent charges, and supply charges, both for the function of operation and the other functions as well, we may now take up the equipment service item.

One phase of this equipment service is that which has to do with proving and handling the work between operations.

This work includes proving the galleys that come from any operative department, cuts, type making, machine and hand composition, make-up and lock-up, and keeping the galleys on file for use on the next operation or corrections. As the basis of handling practically the entire product of all departments, the individual galley (8 3-4 x 13 inches) is suggested. This reduces the work to a minimum for proving and handling. In operation the system could provide that each workman "hands in" to the proving counter (the top of the galley cabinets) the galley of his product as the concluding item of his work. "Handing out" the galley again may be part of the routing routine. For jobs that require larger space than 8 3-4 x 13 inches a set of large galleys is provided, and if a job is too large for these it may be made up directly in the chase on the stone. Proving, including the form proving of gordon and electrotype forms, is all done on the proof press. For stone proofs of cylinder forms the equipment proving service might send the prover to the lock-up department to take the proof and put the form in the form rack. In cases where enough galleys are handled together on one job to warrant it, they may be put in a portable galley cabinet and wheeled to the make-up or lock-up department. Insurance work can be similarly handled in locked chases on special form trucks.

For this service it is estimated that a boy will be employed on the average of four hours a day, or 1200 hours for the year. At 30 cents an hour this amounts to $360 as the cost of this equipment service.

Another service of the function of equipment has to do with the distribution of the foundry type, and the renewal of the supply of type and other material cast by the monotype, and filing cuts. This service includes the unlocking of dead forms and returning lock-up material to the lock-up department, and the disposal of the rest of the material which is almost all type metal and cuts.

This service also includes the refining of metal which will require three or four hours of work once each month.

With this somewhat wide range of work we can estimate that a boy employing four hours a day, or 1200 hours, will see this service well looked after. This, at 30 cents per hour, figures $360 for this phase of equipment service.

In the budget for equipment service it is desirable to include the cost of managing the work, or the item for the function of control that applies to this work. We shall see when we come to segregate the cost of control that an item of $268 will be assigned to the function of equipment for the managing of its 2400 hours of work.

For the equipment service, then, we may sum up the charges as follows:

Equipment use, 18 per cent on $750 investment . .	$ 135
Rent of 170 feet floor space	112
Supplies	50
2400 hours of boy's time, at 30 cents	720
Share of function of control	268
	$1285

SEGREGATING THE EQUIPMENT SERVICE COST

The division of this item of expense among the eight operating departments can be made on the basis of relative service requirements, which may be indicated with approximate accuracy by the proportionate number of galleys of product handled for each.

Of the 300 galleys allotted to handle the bulk of the product between operations the estimate for each of the four departments of composition casting, type making, hand setting, and cuts, 80 were estimated to be used for machine composition, 40 for type casting, 100 for hand setting type, and 80 for cuts. The make-up department, it was estimated, would use the same 80 galleys used in the case of machine composition, the same 100 galleys used in the case of hand setting type, and the same 80 galleys used in handling cuts, a total of 260 galleys for make-up. In other words, the number of galleys actually handled in proving and storing between operations is 560 divided among the five operations as given above. If we add, say, 200 galleys to represent a proportion for the lock-up proving (which is done by forms) and 40 galleys to represent the proving on time work, we can figure each operation's percentage of the total of 800 galleys and apply the same percentage to the total charge of $1285. We arrive at the following:

	Galleys	Per Cent	Charge
Keyboard	none	none	none
Composition casting	80	10	$ 129
Type making	40	5	64
Hand setting	100	12	152
Make-up	260	33	425
Lock-up	200	25	322
Time work	40	5	64
Cuts	80	10	129
	800	100	$1285

The monotype keyboard makes no use of this equipment service and hence is not charged for it.

CUTS

The function of equipment has to do with one other item in the composing room, namely, cuts.

We have added the cut department to the composing room for the reason that handling cuts in the department gives rise to certain charges which cannot conveniently be entered against any other operative department or included in the general expense of equipment service.

We have seen in the discussion of the function of operation that work on cuts both in the make-up and lock-up was estimated to be a total of 503 hour's work at 54 cents, or $272. The work represented the time taken to justify cuts into the page or into the form, and could be almost entirely eliminated if all cuts were received blocked accurately to picas. But even if it could be arranged at no extra cost to have all cuts blocked to picas, this does not represent the last word on efficient handling of cuts in the composing room.

Electrotypes can be handled unmounted quite as cheaply as mounted; that is to say, the cost of justifying a bastard measured, wood blocked, electrotype is at least as much as the cost of putting it on a patent base and adjusting the catches and screws, ready to put it in the page or in the form.

Zinc etchings and halftones can be mounted on high quads (as cast on the monotype as part of composition) if received unmounted, in less time than it takes to justify them into a page or form if they are mounted on a wooden base of bastard measure.

Even ordinary wood blocked cuts can be cut down or built up to even picas on the Miller saw trimmer in less time than it takes to justify them in the page.

It would seem from these facts that it would be a decided saving to buy all cuts used in the department unmounted, and arrange to mount each of them in the manner most economical to its peculiar case.

There is a difference in the market price of mounted and unmounted cuts of all kinds of practically one cent an inch. It is suggested that this saving of one cent an inch for blocking would more than pay the cost of the operation charge for standard blocking in the composing room, no matter what method was employed. To make any sort of an estimate of this probable cost it is necessary to know how many inches of cuts the department handles.

From last year's record of cuts of all classes we have a figure of about $1000 for zincs and halftones and $500 for electrotypes. Some of these were purchased at close market prices which have since advanced, and the figures also include such extras as outlining, vignetting, mortising.

For making an estimate for the volume of business for the cut department for next year, it is desirable to set a cost rate for the raw product which may be called a probable market rate and then expect to buy cheaper if possible. The difference, if any, will be an additional commercial profit for the cut department. Similarly we shall put the number of inches representing the volume of business lower rather than higher than actual expectations, knowing that the increased volume in actual practice means more relative profit. We may estimate the year's business in cuts as follows:

15000	inches electros at 3 cents, unmounted	$ 450
5000	inches zincs at 6 cents, unmounted	300
5000	inches halftones at 15 cents, unmounted	750
20000	inches customers' cuts	none
45000	inches total cuts handled	$1500

This $1500 will be treated as a stores item and charged directly to the cut department as raw material.

ARRANGING THE BUDGET BY FUNCTIONS

This completes the charges in the budget that come under the head of the equipment function, but before tabulating them it is desirable to arrange the charges for the other functions in a similar way.

We shall take up now the summary of charges of each of the other functions segregated into the same eight departments of work.

DISTRIBUTION OF OPERATIVE CHARGES

The labor involved in mounting these cuts (with the equipment provided) is estimated at 300 hours of a workman's time at 60 cents or $180. This item is an additional item of operation (charged to the cut department) and offsets the $270 item "work on cuts" in Table 17.

In Table 17 we have the net figures for operating time and these will represent the entire charge for the function of operation, with the addition of the $180 for cuts. The equipment charges for all operations have been fully covered in the equipment function. It is desirable, however, at this time to arrange the operating charges in accordance with the eight operations. Summing up these charges we have:

Monotype keyboard: 970 hours man's time at 60 cents, $582; corrections 100 hours at 54 cents, $54; a total of $636.

Composition casting: 600 hours boy's time at 30 cents, $180; and 120 hours man's time at 60 cents, $72; a total of $252.

Type making: 500 hours boy's time at 30 cents, $150, and 100 hours man's time at 60 cents, $60; a total of $210.

Hand setting: 530 hours at 65 cents, $345; corrections, 53 hours at 54 cents, $29; a total of $374.

Make-up: 393 hours at 65 cents, $255; corrections, 39 hours at 54 cents, $21; a total of $276.

Lock-up: 118 hours at 65 cents, $77; corrections, 12 hours at 54 cents, $7; a total of $84.

Time work: 425 hours at 54 cents, $227.

Cuts: 300 hours at 60 cents, $180.

DISTRIBUTION OF CONTROL CHARGES

The labor cost of exercising the function of control for the present product was found to be (see Table 17) $800 (600 hours man's time at $1.00, or $600, and 667 girl's time at 30 cents, or $200).

In addition to these items the function of control is charged with all operating time not used in actual work, which we estimated to be 5 per cent.

Applying 5 per cent to the final items of operating cost, the full operating pay roll, as given in the preceding section on operation we have the item of $112 to add to the function of control budget.

As the equipment service work must be controlled we have also an item of 5 per cent of the pay roll ($720) for equipment service, or $36.

Likewise, 5 per cent of the design pay roll, ($910) or $46, must be added.

Also, 5 per cent of the comparison pay roll, which we can here set down as $770 (anticipating the discussion of this function in the next chapter) or $39.

We have, then, the following summary for the charges of the function of control:

Equipment use $100 investment, at 18 per cent	$ 18
Rent of floor space, 132 feet at 66 cents	87
Supplies	25
600 hours man's time at $1.00	600
667 hours girl's time at 30 cents	200
Five per cent of operating pay roll ($2239) not utilized	112
Five per cent of function of equipment pay roll ($720) not utilized	36
Five per cent of function of design pay roll ($910) not utilized	46
Five per cent of function of comparison pay roll ($770) not utilized	39
	$1163

To distribute the cost of the function of control to the eight operating departments, we may take as a basis the number of hours in each department. This segregation of charges means that each department is charged with a share of the expense of management in accordance with the total hours of labor that there are to manage. The hour of the boy at 30 cents takes just as much management as the hour of the skilled man at 75 cents (and perhaps more). The hours of operation time by departments, the percentage of each to the whole and the share of the total control charges are given as follows:

	Number operative hours	Per cent	Share
Monotype keyboard	1070	10	$ 116
Composition casting	720	7	81
Type making	600	6	70
Hand setting	583	6	70
Make-up	432	5	58
Lock-up	130	1	12
Time work	425	4	47
Cuts	300	3	35
Equipment service	2400	23	268
Design	1743	17	197
Comparison	1879	18	209
	10282	100	$1163

DISTRIBUTION OF DESIGN CHARGES

The addition of the cut department makes an addition also in the estimate for the function of design, the necessary work of making out specifications and orders for the purchase of cuts or reblocking customer's cuts. It is estimated that 28 hours of the lay-out man's time at 75 cents will be necessary, or $21, for the cost of design for the 45000 inches of cuts. The summary of the charges for design are as follows:

Charges other than pay roll		
Equipment use of $200 investment at 18 per cent	$ 36	
Rent of floor space, 130 feet at 66 cents	86	
Supplies	50	
Share of function of control	197	
		$369
Pay roll		
80 hours at 75 cents, copy preparation for keyboard	$ 60	
230 hours at 30 cents, transcribing copy for hand setting	69	
93 hours at 75 cents, marking copy for hand setting	70	
612 hours at 75 cents, lay-out for make-up	459	
612 hours at 30 cents, lay-out for make-up	184	
44 hours at 75 cents, diagramming lock-up	33	
44 hours at 30 cents, diagramming lock-up	14	
28 hours at 75 cents marking cut specifications	21	910
		$1279

There are no design requirements for composition casting, type making, or time work, so no charge for design is made against these operations.

To distribute the pay roll part of design charges to the operative departments involved, simply means extending these items to the proper departments. The equipment charge can be distributed on the same basis which would give the following segregation:

	Pay roll	Per cent	Other charges
Keyboard	$ 60	7	$ 26
Hand setting	139	15	55
Make-up	643	71	263
Lock-up	47	5	18
Cuts	21	2	7
	$910	100	$369

DISTRIBUTION OF COMPARISON CHARGES

We may again anticipate the discussion of the function of comparison which will be taken up in the next chapter and give here the list of charges for this function segregated by operations. The charges follow:

Charges other than pay roll		
Equipment use of $100 investment at 18 per cent	$ 18	
Rent of floor space, 40 feet at 66 cents	26	
Supplies	50	
Share of function of control	209	
		$303
Pay roll		
Time and product record system		
1200 hours at 30 cents		360
Inspection service		
121 hours at 60 cents, first reading on 2430M ems machine matter	72	
121 hours at 30 cents, copy holding on same	36	
31 hours at 60 cents, first reading on 630M ems hand set matter	19	
31 hours at 30 cents, copy holding on same	9	
152 hours at 60 cents, second reading on 3060M ems made up matter	91	
47 hours at 60 cents, OKing locked forms, 2360M ems matter	28	
100 hours at 60 cents inspecting 21,000 pounds type, slugs, and rules	60	
43 hours at 60 cents, revising author's changes and other time work	25	
33 hours at 60 cents, inspecting 45,000 inches cuts	20	360
		$1023

In distributing the inspection service charges the items can be extended directly to the operations affected.

The equipment charge ($303) and the time and product record system cost ($360) can be distributed on the basis of number of hours employed in each operating department. This is shown in the following summary:

	Hours	Per cent	Charge
Keyboard	1070	25	$166
Composition casting	720	17	113
Type making	600	14	93
Hand setting	583	14	93
Make-up	432	10	66
Lock-up	130	3	19
Time work	425	10	66
Cuts	300	7	47
	4260	100	$663

These charges for all functions are exhibited on Table 18 in detail. This budget represents the conditions after all functions have been standardized. It will be noticed that the complete cost of each function is shown as well as the complete cost of each operating department. Reading across the table any one item may be traced for the different departments. Reading vertically the cost of any department may be traced by functions.

SOME SPECIAL SYSTEMS

In connection with the function of equipment we may now take note of several special systems which are designed to standardize the work and make for efficiency.

TABLE 18 *Costs by functions*

		Key-board	Composition casting	Type making	Hand setting	Make-up	Lock-up	Time work	Cuts
Operating equipment.	$10812	$ 770	$3205	$2939	$1458	$ 815	$ 625	......	$1000
Operating floor space.	817 ft.	66 ft.	92 ft.	44 ft.	150 ft.	168 ft.	144 ft.	......	153 ft.
Product handled.....	......	2430M ems	2430M ems	21000 lbs.	630M ems	3060M ems	2360M ems	425 hours	45000 inches
Function of equipment:									
Operative equipment use........	$1951	$ 139	$ 580	$ 530	$ 262	$ 147	$ 113	......	$ 180
Rent of floor space..	540	44	61	29	99	111	95	......	101
Supplies...........	190	25	50	50	10	10	10	$ 10	25
Equipment service..	1285	......	129	64	152	425	322	64	129
Cuts purchased....	1500	......	......	......	......	......	......	......	1500
Total...........	5466	208	820	673	523	693	540	74	1935
Function of operation:									
Pay roll for operation	2239	636	252	210	374	276	84	227	180
Function of control:									
Control of operation	489	116	81	70	70	58	12	47	35
Function of design:									
Equipment use, rent, supplies and control	369	26	......	......	55	263	18	......	7
Pay roll for design..	910	60	......	......	139	643	47	......	21
Total...........	1279	86	......	......	194	906	65	......	28
Function of comparison:									
Equipment use, rent, supplies and control......$303									
Payroll for cost keeping..... 360	663	166	113	93	93	66	19	66	47
Payroll for proof-reading..........	360	108	......	60	28	91	28	25	20
Total...........	1023	274	113	153	121	157	47	91	67
Total five functions..	$10496	$1320	$1266	$1106	$1282	$2090	$ 748	$ 439	$2245
Type making charged to hand setting and make-up..........	$10496	$1320	$1266	......	$1598	$2880	$ 748	$ 439	$2245
Rates..............		$.544 per M ems	$.52 per M ems	$.0527 per lb.	$2.54 per M ems	$.94 per M ems	$.297 per M ems	$1.03 per hour	$.0165 per inch

CUT SYSTEM

Making the cut department one of the composing room manufacturing units means providing a definite routine for the handling of all cuts, which may here be suggested in detail.

The "record of product" for this department, for the year, will be a set of proofs showing every cut handled in composition during the period. Whenever a cut is used on a job, then, the first requirement is that it be given to the proof boy for proving. The proof boy is supplied with specially prepared proof paper for this purpose. These could be 8 1-2 x 11 inch sheets, or multiples of this for large cuts, punched for file, printed with necessary blanks for date, number inches, job number, etc. A proof on this stock is used for calculating the number of inches and charging to the job, and constitutes, when bound up with the proofs of all other cuts, the complete physical record of product of the cut department.

Whenever a cut is specified on a job, the source from which it is to come is noted by the sales department on the job ticket, and thus the superintendent knows when he is given the details of a job whether the cuts are to be provided by the customer, taken out of the file, or ordered made new for the job.

Whatever the source, he sees that the cuts are actually on hand, and turns them over to the prover, giving him at the same time the job number on which they are to be used. In practice the superintendent may handle this matter simply by giving the prover a memorandum of three or four cut file numbers with a job number, or he may give the prover a duplicate copy of his order on the engraver for a set of cuts, this order having the job number on it.

The proof boy, on receipt of cuts, or an order to get cuts out of the file, proceeds to take the special proof already mentioned for the product record and also two other proofs on white stock. He marks all proofs with the job number, cleans the cuts, puts them on galleys in his galley cabinet and marks the proofs again with this galley rack number. If a cut happens to be mounted the proof boy notes this on the product proof where space is provided for this purpose.

The special product proof and the two other proofs go to the lay-out man who uses one white proof in pasting up the lay-out for make-up and the other as an order for blocking instructions and make-up. The product record proof with the lay-out man's OK on it to indicate his inspection of it for size and blocking, goes to the cost clerk for use in the records.

When forms containing cuts are unlocked cuts are disposed of by the proof boy in accordance with order from the superintendent.

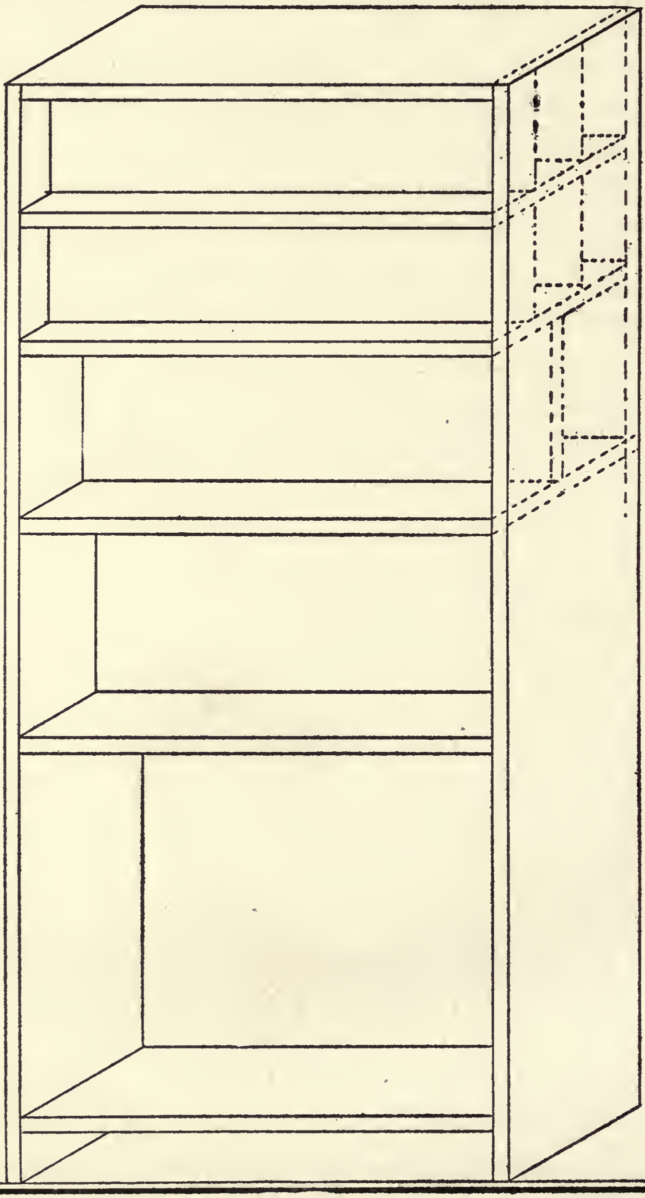
The cut file may consist of a cabinet about 30 x 70 x 12 inches, designed to hold 100 cut boxes 4 1-2 x 6, 50 boxes 6 x 9, 25 boxes 9 x 12, and 25 boxes 12 x 22, a total space for 200 cuts. (See diagram.)

Cuts are placed in cabinet by the proof boy who sees that a proof of the cut marked with box number and name of customer is placed on file. Cut is stamped with number of box.

When cuts on file are ordered for a job they are located by reference to the index, taken from box and the box turned open end front in the rack. No record is made of cuts taken out to use in the shop. If cut is taken to deliver to customer its box is

CHART E

CUT RACK UNIT



These four shelves for 25 cut boxes 4½ x 6 in. each

Two shelves for 25 boxes 6 x 9 each

25 boxes 9 x 12

25 boxes 12 x 22

made vacant to be used by another cut, the proof is taken from file and, receipted for delivery, kept on file as separate record. The cut ceases to be part of the storage system and its number stamped on its base looses its significance. If the same cut should be received at a future date and placed again in storage it is assigned a new box and a new proof put in the index. Boxes on the shelf to which no cuts have been assigned are turned to the front with numbers showing upside down. Thus boxes showing numbers in regular way indicate cuts on file with proof in index (alphabetically arranged by customers), boxes showing open end indicate cut is in shop being used on job, boxes with numbers showing in reverse indicate unassigned boxes.

In assigning a cut to a box the first unassigned box in the size required is taken, the cut being stamped with the box number, which also is put on proof in index.

Boxes are numbered consecutively from 1 to 200, in the first unit, 201 to 400 in second unit, etc.

The cut index consists of proof sheets 9 x 12 (and some double size 12 x 18) punched for ring binder. Alphabetical index sheet guides A to Z are inserted. Decorative cuts belonging to the house are filed separately, and if enough accumulate to become confusing, they may be sub-indexed with such groups as "Borders," "Head and Tail Pieces," "Bradley Designs," "Christmas Ornaments," etc.

An important rule in operating the cut system is that no cut is to be delivered to a customer without a receipt on the cut index sheet. Taking this proof sheet out of the index and filing it under cuts delivered to customers constitutes the entire record of cuts that have been on file and delivered. The proof boy is responsible for having a cut in the file for every proof in the index and should be able to show a receipt for every cut which has ever been in the house and has been delivered. When cuts are received from a customer to be used on a job and returned to him when the job is completed, these cuts do not go into the cut cabinet and are not assigned boxes or numbers. Receipts for delivery of these cuts must be carefully preserved and can be filed in cuts delivered file. Any question about the whereabouts of any cut can be answered by reference to cuts delivered file or the cut index. If there is no proof of the cut in either of these files it is clear that the cut in question has never been received by the shop.

FLOOR PLAN

In determining the rental charge a floor plan showing the arrangement of all equipment in the composing room was submitted. We may consider now some of the features of this floor plan aside from the matter of square feet for each operation.

Equipment for the entire function of operation is grouped in the natural sequence, each of the eight kinds of operation having its separate working space. Provision for corrections is not made as a separate operation as this will be done either in the hand setting or make-up alley, or on the stone, or possibly on the press, as occasion demands.

The superintendent's quarters are placed where they will be most convenient to the work of the whole shop, as the function of control for the composing room is only part of the general function of control represented by the superintendent.

The lay-out department, comprising the function of design for the composing room, is placed convenient to the superintendent, as orders for work in this department come from the superintendent and the finished work (i. e., prepared copy and lay-outs) is handed back to him.

Proof-reading and cost keeping are also placed convenient to the superintendent as their work is auxiliary to the superintendent.

Handling type in progress or between operations is a function of equipment, as well as the proving. The routine exercise of the function of equipment in the composing room is auxiliary to the control function. Hence in placing the storage racks for galleys of live jobs it is the aim to have them reasonably near the superintendent and as close as possible to all work of operation. The transportation system in the composing room is thus reduced to its lowest possible term, each kind of operation can be done without walking from its working position, and the finished product can be delivered to a definite point which is placed so that it can be reached with the fewest steps.

The proposed arrangement of equipment allows an unobstructed passage way from the press room to the hall.

Under this arrangement there is a minimum of running around in the department. The work of the proof boy when engaged in distributing type and restoring making-up and lock-up material takes him somewhat from place to place, but the only other movement on the part of workers in the department occurs when a man finishes the job he is on and delivers it to the prover and gets the next job from the superintendent.

It is interesting to note that the transportation system in the composing room is simplified by the fact that after every operation (machine setting, hand setting, make-up, lock-up and corrections) the product must be proved. Delivery to the prover really amounts to handing on the material to the next operation. In the case of cylinder forms which cannot be proved on the proof press, the proof is taken on the stone and the form placed in a special form rack near at hand. This apparent change does not make proving part of the lock-up operation however, the proof boy is merely sent to the form instead of having the form brought to him.

Another feature of this lay-out of floor space is that it allows for an increase of product with but small change in lay-out.

Another monotype keyboard and caster could be added in the space allotted to the monotype at present.

The setting alley allows space for two workmen, whereas the present product can be handled by one. The make-up alley also provides space for two workmen.

The stone room will accommodate twice the number of forms called for under present volume of work.

The other work spaces in the department might have to be increased somewhat for a large increase in work but not to any great extent.

In the case of insurance changes the operations of make-up and lock-up are combined, and thus the lock-up time is practically eliminated. A special work place consisting of a stone with special material above and a form rack below is provided for this work. Notice that this applies to the make-up and lock-up only. The other work on insurance changes follows the regular method of production. The orders are given first to the lay-out man who prepares the copy with complete instructions for setting and make-up. The setting is done either on the machine or by hand as a regular operation. The set type goes to the prover. The proof is read by the proof-reader in the regular way and corrections are made, if necessary, by the regular corrector. The corrected proof with directions for make-up and lock-up goes to the make-up man who does the rest of the work at the special work place mentioned.

Where jobs are too large for make-up on the large sized galleys they are made up and locked up at one operation on one of the stones.

INDIVIDUAL GALLEY SYSTEM

For the equipment service work of handling product between operations it was noted in discussing equipment that the plan suggested using individual galleys 8 3-4 x 13 inches for practically everything where possible.

This sized galley will take care of almost all the pages that are to be made up. The few pages that are larger are provided for by a small supply of large galleys and the possibility of making up directly in the chase for large forms. The bulk of the product can be handled on these 8 3-4 x 13 galleys and a definite routine established for their handling, the same routine applying to the larger galleys.

Composition casting can be done directly into these individual galleys, and hence but one sized galley will be needed for the monotype and for hand setting. This means that proofs on stock 8 1-2 x 11 will be the only size handled by the proof-reader except occasionally one that is 11 x 17 or 17 x 22. The time honored custom of having 24 inch proofs, which makes good proving difficult, and are about the clumsiest things for the proof-reader to handle that could be invented, gives way to a more rational system of having everything possible standardized to 8 1-2 x 11 inches size, which business correspondence would seem to indicate was a convenient size to handle.

It may be added, parenthetically, that the 24 inch galley has nothing to recommend it as a composing room tool except custom. The supposed advantage of running a long take on the composing machine, or by hand, is entirely lost by the inconvenience that is caused in every subsequent operation from proof-reading, corrections, make-up and lock-up to distribution.

Cuts can be placed on these same galleys either singly or several to a galley. Hence if the routine is followed of turning over all cuts immediately on arrival to the proof boy, and he puts them on galleys where they remain until made up, there is no possibility of cuts lying around on tables, or shelves, or case tops or stones, where they are easily scratched and generally clutter up the shop.

When the order to make-up a job is given by the superintendent to the workman, he gives him the lay-out and list of materials (as fully prepared by the lay-out department) and a proof of each of the galleys of material that enters into the page or series of pages. It will be seen that this galley system simplifies things considerably for the make-up man. Instead of having a couple of 24 inch galleys of machine matter, a handful of little cuts and a couple of large cuts, and some copy that may be on various sized bits of paper, with instructions to set hand set matter and make the whole up into a dozen pages, he has simply a number of standard sized galleys in a portable rack, and a bunch of 8 1-2 x 11 inch sheets of paper consisting of proofs, lay-out, etc.

In lock-up work the value of the standard galley system is again apparent. Here also the lock-up man receives his pages either singly or in a portable rack and instructions on 8 1-2 x 11 inch sheets.

For type casting, the same galleys are used and the product proved so that it can be inspected before being put in the case. Leads, slugs and rules, in standard lengths will not run more than 12 inches, or 72 picas in length, and can hence be placed on these same galleys and kept in galley racks as storage. As all product from the type casting department is to be weighed on casting, it will prove a convenience to handle the product on the standard galley and set the scales used with this galley as tare.

SALVAGE

A part of the general function of equipment which pertains to the whole shop is the important matter of salvaging whatever wastes can be recovered from routine operations. This is a part of the stores division, and provision should be made in each department to save all waste materials as a part of the regular routine. The gathering, storing, utilizing or transforming these waste materials into their most salable form and marketing them is a separate equipment service and not part of the work of any operating department. This equipment service, acting for the whole shop, would probably be able to show a handsome cash profit on a year's work, even with the present volume of business.

The material wastes in the composing room that are worth making the subject of a routine provision for saving may be enumerated as follows:

Keyboard paper

The perforated paper ribbon used on the keyboard and later on the caster of the monotype has a value as clear white paper waste after it has served its usefulness in operation. To recover this value it is simply necessary to have a routine method of marking those ribbons that are to be kept standing, i. e., saved so as to recast the job without rekeyboarding, and providing a definite container (a gunny sack would answer) to receive the rest of the ribbons. Of course all ribbons would be held for, say, a week, after casting to insure against a possible pi of the material during subsequent handling.

Type metal dross

In operating the monotype caster, it is necessary to skim the melting pot at least once a day to insure clean metal for casting. As these skimmings contain valuable metal they are kept and melted up with the dead type. This recovers most of the value from this dross from the monotype caster, but in refining the dead type there is always considerable dross which has no usable value for the machine but has a commercial value which makes it worth saving and selling. To save this dross from refining means simply to provide suitable boxes to contain, say, 50 pounds for the man who does the refining and seeing to it that his records for his work include this item delivered to the store room.

Tie-up string

With the use of the grooved tie-up slug, pages can be locked without taking off the tie-up string. When the galley boy unlocks a form and disposes of the material he can well make a practice of putting the page cords into a container provided for that purpose and turning it in to the store room whenever it becomes filled. In the aggregate, this string, with whatever waste string and rope is accumulated from the shipping and receiving department, will make a salvage item worth saving.

Cut blocks and metal

The cut department will naturally accumulate dead cuts of all kinds, and may even have a quantity of blocks from which live cuts have been removed. Provision should be made to designate dead cuts whenever possible so that the cut file will contain only cuts belonging to customers or house cuts which it is desirable to keep on hand. Separate boxes for zinc, copper, stereotype metal, electrotypes and wood blocks, can be provided so that this material can be easily saved. The metal shavings from the Miller saw trimmer can be provided for also.

Copy, lay-out and proof paper

The routine of handling copy, lay-outs and proofs provides for keeping this material on file as long as it serves some definite purpose. After it has served its purpose it becomes waste and is a salvage item that is worth providing for. In fact the general salvage item of waste paper involving the offcuts from stock cutting and the trimmings from pamphlet binding; the spoiled sheets, tympan, and make-ready sheets, from the press room; the wrapping paper from the receiving department; the waste paper from the office; and spoiled jobs; as well as keyboard paper and copy lay-out sheets may well become under careful handling the most profitable of all salvage items.

The proper salvaging of wastes has an importance aside from money profit in making for a clean, well ordered shop. If waste paper, page cord, metal dross and old cuts become an object of definite looking after, there is little chance for their becoming a nuisance by kicking around where they are not wanted.

STREET CAR CARDS

One form of special work which makes a peculiar demand on the composing room equipment is that of street car cards. In this same class of work might also be included large display folders, broadsides, window cards and advertising spreads.

In all this class of work the demand is made for display in large type. As the contemplated type equipment includes 36 point in the non-distribution system and puts 42 point and larger in a separate class requiring foundry type and a distributing system, we may say that this question of big type is a question of this second class of type only.

The designing requirements of street cards and other large display printing (outside the field of posters and bill boards) is the same as for advertising display in general, with this important difference: that in using type larger than 36 point the style of the type face is of more importance from the standpoint of letter design than in the case of smaller type.

As printers generally have restricted their investment in large size type to but one or two fonts of 42 to 72 point and but one or two fonts of wood type in larger sizes, the custom of the trade has brought it about that advertisers have made practically no demands on typographical designing in type of large size. Hence it happens that, as market conditions now are, the artist has been called in for a great deal of hand lettering to do what typography is not equipped to do.

This is seen in the case of street car cards where hand lettering is used probably in equal proportions to type, and the result of the hand lettering is as a rule vastly superior to the type effects.

Hand lettering has no advantages over type display if the designer of the type lay-out has a fair equipment to work with, and as much artistic skill at display as the artist who does hand lettering.

The proposition of getting good display in street car cards, as far as the lettering is concerned, depends almost entirely on the type equipment available.

The best lettering of the most skillful artists has within the last year or so become available in type, and since these same styles can be cut to order as wood type in any size, it would seem to be a matter of practical concern to select an equipment of large size type which would make it possible to secure the very best typographical effects that skillful designing could plan.

The six standard styles of the regular equipment offer a good equipment for much of the style demands on large size type, but they do not give all the variety that could be used to advantage for this class of work.

The reason for this is obvious. In the 10 point size, for example, one has to look twice at a piece of printing, to distinguish between, say, Cheltenham and Cloister roman, or between a modern and an old style roman. But in a street car card where the display line consists of but a single word, perhaps, the difference between using Cheltenham or Cloister roman is more apparent and the atmosphere of the whole design may be changed entirely by a change of type style. In big type work the quality of the designing of the whole display is intimately wrought up in the quality of the designing of each individual letter, while in small type display the designing is mainly in the grouping of the type.

Referring to the list of type in use at present as given in Table 5 we note the following as the inventory in pounds of styles in 42 to 72 point:

	42 point	48 point	60 point	72 point
Caslon	19	..	..	..
Cheltenham	..	18	..	..
Cheltenham bold	50	62	67	48
Caslon bold	..	31	..	..
Caslon bold italic	..	10	..	..
Cheltenham bold outline	..	24	..	49
Avil	..	50	52	..
Bodoni	14	18	25	25
Della Robbia	..	31	..	..
Tiffany upright	..	9	..	..
Tiffany script	..	10	..	..
Gothic outline	..	10	..	..
Gothic condensed	..	11	20	..
Gothic extra condensed	..	18	..	..
Ad type	..	37	45	50
Plymouth condensed	..	12	..	..
Plymouth italic	..	15	..	..
Post	..	13	..	..
De Vinne	..	..	44	39

The regular equipment of all type faces includes six styles in the four sizes, 42, 48, 60, and 72 point as follows:

- Roman
- Roman italic
- Medium roman
- Medium roman italic
- Bold roman
- Bold roman italic

If Caslon were selected for the light roman, Cheltenham for the medium roman and Cheltenham bold for the bold roman, then the foregoing list of type on hand would yield in addition to the regular equipment the following desirable faces:

	42 point	48 point	60 point	72 point
Caslon bold	31	..	..	..
Caslon bold italic	10	..	..	..
Cheltenham bold outline	..	24	..	49
Avil	..	50	52	..
Bodoni	14	18	25	25

Caslon bold and Caslon bold italic are welcome as giving a variety of bold not quite so emphatic as Cheltenham bold. The Cheltenham bold outline is especially useful in street car work as it gives opportunity for two color effects. Avil has some of the good qualities of the best hand lettering but is rather condensed. On street car work condensed faces should be avoided, as the position is such that most people see it at an angle and consequently foreshortened. This has the effect of making normal faces appear condensed as a regular thing, and to use a condensed letter would give an effect of so much condensation that the card would be in danger of becoming illegible, which is a fault that no amount of clever designing will remedy. Bodoni, as an example of an extreme modern roman, has occasional use as a variation from the Caslon, which represents the extreme old style roman.

These styles (with the possible exception of Avil and Caslon bold italic) should be completed in all four sizes so that the lay-out man can use any one style consistently in any piece of display.

In addition to these styles three other styles are suggested as desirable to round out the equipment for large size type work.

Cloister roman, a medium weight letter, shows its fine proportions to best advantage in the large sizes and would add considerable class to the jobs on which it were used. As this is an old style letter it can be used in perfect harmony with Caslon old style.

Cloister text is another type face that should be available for large type display. There are occasions when a single word in large old English characters will give a wealth of display to a piece of composition that no other type face can supply. The Cloister text letter is very close to the black letter of the early printers, being just enough opened up to give it fair legibility. The letters of both capitals and lower case are richly decorative in themselves, and in the large sizes perfectly legible. For a rich mass of color, this letter cannot be equalled.

Goudy title is a recently cut type face of capitals of the American Type Founders Company which is, in my opinion, just about the final word in satisfactory designing of the old style roman capitals. A series of these capital fonts for the occasional one or two word display heading will round out the lay-out man's available type faces to such an extent that he can produce results which, as far as the lettering is concerned, could not be surpassed by the leading artists in the business.

Summing up the type faces that would comprise the full equipment for street car work and other large display typography we have the following faces each in 42, 48, 60 and 72 point:

Caslon old style
Caslon old style italic
Cheltenham
Cheltenham italic
Cheltenham bold
Cheltenham bold italic
Caslon bold
Bodoni
Cloister old style
Cloister text
Goudy title (capitals only)

In addition to this list it is desirable to have a small supply of type larger than 72 point. The present supply of wood type consists of the following:

4 line condensed gothic
5 line square gothic (caps only)
6 line condensed gothic
6 line old style (Caslon bold)
6 line old style condensed
8 line Foster condensed
8 line Foster condensed outline
10 line Foster condensed
10 line Foster condensed outline
8 line condensed gothic
10 line condensed gothic
15 line condensed gothic
15 line "class N" capitals

The 6 line old style, which is the equivalent of 84 point Caslon bold, and the 8 and 10 line Foster and Foster outline, which could be used as the equivalent of Cheltenham bold, would offer desirable additions to the type equipment for carefully designed large type display. The rest of the present supply of wood type belongs in the special equipment for poster work, an entirely different class of work from that which we are here considering.

To round out the supply of larger-than-72-point equipment it is suggested that a font of Goudy title, in the 6 line, 8 line, 10 line and 12 line sizes (capitals only) be added. This would give the designer the opportunity to use a large display letter in caps up to two inches in height in the one most perfectly proportioned style of roman. This letter will combine well with almost any other style roman in display and hence may be said to be the logical choice for the one series of wood type that is to take care of all larger-than-72-point display.

The street car card work will probably operate on the basis of a very short turn over period for the use of the type. There is practically no standing matter connected with the work and the routine is that as soon as a lot of cards is delivered the type may be released. For this class of work a ten day turnover of type can be figured as being safe. This means that very small fonts of type would be needed.

The type equipment for special work was given in the inventory of type for the hand setting department as 14 fonts, 25 pounds each, 350 pounds, at 60 cents, $210. The equipment for the street car card work if based on the foregoing selection of type faces would amount to 20 fonts of type averaging, say 10 pounds each, at 60 cents, $120 and 4 fonts of wood type costing, say, $80, a total of $200.

The cost of equipment, then, for this special work will not exceed the allowance for special equipment included in the figures for determining the hand setting rates. We may say then that the street car cards can be designed and set up with the full use of the equipment as suggested at the regular cost rates applying to hand composition. As much of this work can be sold as the equivalent of hand lettering it seems reasonable to say that a selling price schedule for this work could be drawn up which would insure a handsome profit on the cost of manufacture. It is interesting to observe that the faces selected in addition to the regular equipment for this special work of street car cards would also be the natural faces for sizes smaller than 42 point, if such variety should be deemed necessary. In the case of Cloister old style and Goudy title the additions would have to be made in the shape of foundry type and hence part of the distribution system. The other additions, however, could be made by purchasing or renting the matrices for the monotype and casting the type, thus making these additions part of the non-distribution system.

We shall see in the discussion on rates that hand setting for type on the non-distribution system takes one rate, while matter set from foundry type takes a double price rate. As all of the large type additions that we have considered take this double price rate anyway there is no objection to having as wide a variety of faces as may be useful. In the case of sizes smaller than 42 point, however, it is desirable to keep the variety of faces limited to those which can be produced on the monotype as this puts these faces on the non-distribution system. If Cloister old style were added in the small sizes it would always take the double price for its composition rate because it cannot be put on the non-distribution basis. There is the possibility, however, that the monotype company will cut this style for the machine sometime in the future.

IX-The Function of COMPARISON

ALL THE WORK OF MANAGEMENT that may be said to be statistical in form, or which involves physical measurements of any kind, belongs to the function of comparison. In every case where quantities are to be determined, measured, weighed, counted, recorded or compared, this is part of the function of comparison. In the composing room we have two distinct phases of comparison in the routine work, that of inspection, which is mainly proof-reading, and that of cost keeping. We shall consider first the inspection work of the composing room.

PROOF-READING

In all the cost tables but the last, we have listed proof-reading as a separate operation in the composing room, mainly because we had figures for its cost already separate from other costs. Proof-reading, as we have seen in the analysis of the work into five functions, is not a separate operative function but the comparison or inspection service rendered to all operations.

To determine the cost of this phase of the function of comparison it is necessary to estimate the cost rate at which proof-reading, or inspecting for the different operations can be accomplished.

For a routine to apply to all regular work, the following is suggested as ample to secure a high degree of accuracy in proof-reading: a first reading by copy with copy holder on all machine and hand set matter, a second complete reading (without copy holder) of the same matter when made up including a revision of the corrections marked in the first reading, and inspection for spacing according to lay-out, a revision of make-up corrections on the stone proof including general inspection for spacing and position. In addition to this work, which represents the entire inspection as far as the composing room is concerned, the press proof is passed for final printing including a revision of the stone proof. This final passing of the form is not part of the composing room work.

It is estimated that the proof-reader can read at the rate of 20M actual ems per hour on first and second reading, and that OKing the form proof will represent work at the rate of 50M actual ems per hour. Applying these estimates to the product for the year, and using 60 cents an hour as the wage of the proof-reader, and 30 cents an hour for the wage of the copy holder, we have the following charges for inspection of the operations given:

Keyboard work, 121 hours at 60 cents, first reading 2430M ems, $72; 121 hours at 30 cents, copy holding on same, $36	$108
Hand setting, 31 hours at 60 cents, first reading 630M ems, $19; 31 hours at 30 cents, copy holding on same, $9	28
Make-up, 152 hours at 60 cents, second reading and revising, 3060M ems	91
Lock-up, 47 hours at 60 cents, OKing 2360M ems	28

In addition to these charges we have the following estimates for the other operative departments:

Composition casting (the inspection of this work is included in keyboard work)	none
Type making, 100 hours at 60 cents, inspecting 21,000 pounds type, rules, slugs	60
Time work, 43 hours at 60 cents, revising author's changes (one hour's revision for each 10 hours author's changes)	25
Cuts, 33 hours at 60 cents, inspecting 45,000 inches cuts	20

To insure accuracy of proof-reading

In order to standardize the proof-reading work the following plan might be serviceable.

This plan is simply to have the first proofs for machine or hand set matter, and the make-up page proofs go to the proof-reader with one or two known errors already recorded, "planted" in each galley or page. The monotype operator or hand compositor simply makes a note on a special memorandum blank, giving the galley number and line in which a known mistake exists. On the keyboard mistakes need not be made purposely as the operator is usually conscious of striking a wrong key or mispelling a word as soon as he does it. In hand composition the compositor will probably find at least one error to the galley in reading his matter, which he can leave uncorrected and note on his planted error sheet. In make-up, the make-up man may have to deliberately plant the error by transposing a couple of letters, inverting a letter or breaking off a character.

The memoranda of these planted errors are handed to the superintendent who, of course, keeps them until the proof-reader has read the proofs affected.

The important thing in this work is accuracy and not speed, and hence any successful plan must emphasize accuracy above any other consideration.

After the proofs have been read and all errors supposedly marked, the planted errors are checked up, and if all are found to have been caught by the proof-reader, then his work may be said to be 100 per cent perfect. If 10 per cent of the planted errors have been overlooked by the proof-reader then it is safe to assume he has overlooked 10 per cent of all possible errors on these same proofs, and proof-reading efficiency to the extent of overlooking one tenth the errors is no efficiency at all. A one per cent limit of proof-reading inefficiency would probably be a fair basis for each reading. On this basis the proof-reader could be encouraged to speed his work to any extent possible so long as his accuracy did not fall below the standard measured by one per cent of the planted errors, and a bonus for speed could be offered as long as this accuracy test was met.

One advantage of this check on the accuracy of proof-reading is that it produces the very attitude of mind on the part of the proof-reader that is essential to good work. His business is to catch errors, and if he knows there are certain errors deliberately planted in the proof before him, his whole faculties are concentrated on catching those errors. He can never fall in the rut, as most proof-readers do occasionally when working in the usual way, of thinking to himself the proof is probably correct and he can take a chance by looking it through hurriedly. At such a time he is not looking for errors at all, he is looking for correct composition. To do good inspection the proof-reader must be ever alert to look for faults and not perfection.

COST KEEPING

The cost of routine cost keeping for the composing room can be estimated fairly accurately if we know the amount and nature of the work involved. The exact details of what forms are necessary and how they are to be used will be discussed later, as these involve, not only the routine cost keeping, but the whole system of cost. We can estimate, however, that the clerical work involved will not exceed half a day's time regularly on the part of a girl whose wages are 30 cents per hour. This amounts to $360 for the year and is divided among the eight operative departments, along with other general expenses of the function of comparison (equipment use, rent of floor space, supplies and share of control) on the basis of the number of hours' work in each of those departments.

It is seen in Table 18 that the entire cost of the function of comparison is $1023, while in Table 17 the cost of cost keeping is given as $500, and proof-reading as $944, a total of $1444. It would seem then, that the standardization of the function of comparison would yield a saving of $421 over present charges.

A PRODUCT MEASURE FOR MACHINE SETTING

We have seen that in Table 18 the cost rates for monotype work, hand setting, make-up and lock-up, were given in terms of actual ems.

This form of measurement, while accurate as far as expressing the average for the year's work, is not of practical use when applied to any particular thousand ems of product, and hence can not be used as an exact product measure for cost finding purposes.

In order to make practical use of the rates based on the measurement of the actual ems it is necessary to transform actual ems into what may be termed "measured ems," with the intention of making each thousand measured ems represent as nearly as possible a unit whose manufacturing cost is the same.

In the case of keyboard work we may follow the trade custom of machine composition and adopt a simple system of measuring all matter as single price, price and one-half, or double price matter. The rules for determining the class of matter for a given thousand ems are well enough established to serve our purpose here. Thus, matter with small caps or bold face, or leader work is measured price and one-half for each line affected. Tabular work is always double price, and especially intricate tabulations may take even double-double price. Measures shorter than 20 ems are measured as 20 ems in every case.

If the 2430M actual ems, which represent the keyboard product in Table 18 were measured on the above basis what would be the total?

To answer this question we shall have to do some figuring from the data which was originally used in the case of machine composition purchased. In Table one we note that the item for purchased machine set matter for the year was $1583 which included besides actual composition the proof-reading. The average purchase price, on the basis of measured ems, including proof-reading was probably around 55 cents. This would give a measured em product for the year of 2880M. The actual em product for this same purchase price was figured out (from an actual measurement of 38 jobs representing about one seventh of the total purchase, shown in Table 3) to be 1830M. From these two figures we can conclude that in the case of machine composition 57 per cent of the actual ems must be added to the actual em figures to give the measured em total.

In the case of monotype keyboard work this percentage will be likely to be larger rather than smaller than for purchased machine matter which was mostly linotype work. The ability of the monotype to take care of tabular matter which cannot be handled so readily by the linotype, would probably add considerably to this percentage of extra price matter. As our data is not such as to be considered absolutely final on this question of measured product, we may assume that in the case of the monotype keyboard work the measured ems will be the actual ems plus 50 per cent. This means that everything on the keyboard averages price and one-half matter, which seems reasonable on the supposition that a third of the matter is single price, a third price and one-half and a third double price.

The 2430M actual ems of keyboard product in Table 18, if translated into measured ems by a 50 per cent increase, gives the product as 3645M measured ems. (This is not the same as the product in Table 1 for all the insurance work that can be set on the machine has been added.)

The total cost of keyboarding the product, as given in Table 18, of course, remains the same and the rate on this basis of measured ems instead of actual ems becomes ($1320 divided by 3645M) 37.2 cents.

This change in method of measuring the product, while in no way affecting the money cost of the operation or service charges, alters the rates at which these costs were figured. For example, in figuring the operating time for the keyboard the cost rate was used of 24.5 cents per thousand actual ems (2500 ems average per hour at a wage cost of 60 cents). Using measured ems as a basis the cost rate becomes 16.5 cents per thousand measured ems (1666 actual ems double price matter, 2500 actual ems price and a half matter, or 3333 actual ems straight matter per hour, at a wage cost of 60 cents).

In composition casting there is no difference in the rate of casting due to extra price matter, the caster runs at the same speed for casting single price straight matter and a double price table. The cost rate per thousand actual ems is in exact terms of actual operation. But since this rate based on actual ems cannot easily be combined with the keyboard rate based on measured ems, it is desirable to translate the caster rate into the same terms as the keyboard rate. For the purpose of securing a rate which can be handled intelligently it is of practical advantage to consider the product of composition casting as 3645M measured ems and figure the cost rate as ($1266 divided by 3645M) 34.8 cents.

The complete cost of monotype composition, keyboarding and casting, including proof-reading and corrections is seen to be 71 cents per thousand measured ems (36.2 cents keyboarding and 34.8 cents casting).

A PRODUCT MEASURE FOR HAND SETTING

In the case of hand setting, the rate of $2.54 per thousand actual ems represents the average of all sizes of type set. As only minimum quantities of 12 point and smaller are planned to be set by hand, this rate is the average rate for the nine sizes, 14, 18, 24, 30, 36, 42, 48, 60 and 72. As pointed out in the chapter on type supply, each of these sizes has its own rate which can be determined by segregating the total cost into classes corresponding to these sizes. In practical use, however, we cannot handle nine different rates for these nine type sizes, no matter how exactly we may determine their relative costs. An averaged rate of some sort to represent hand composition is essential to estimating and checking the product.

We have seen that a simple average of rates would include such varying rates as $3.73 and $33.00 (Table 4). It is desirable to introduce a factor which will lessen as much as possible this wide variation.

If we adopt as a basis of measure for hand set type of sizes above 12 point, the number of ems the matter makes if measured as 12 point face and whatever body it happens to be, and counting all type 42 point and larger as double price, then we have at once a practical method of averaging the rates on a basis which is fairly representative of the actual facts, and an easy method of measuring hand composition.

To measure type on this basis we simply count the number of lines in the piece of composition (counting 42 point and larger lines twice) and multiply this number by the number of picas in the longest line, using 20 as a minimum. Even if the composition includes lines of all nine sizes, the number of ems depth of page is accurately expressed by the number of lines (each size counts as an em) and, since set-wise the method reduces everything to the pica, the number of ems in each line is accurately determined by measuring the longest line in picas, using 20 for a minimum.

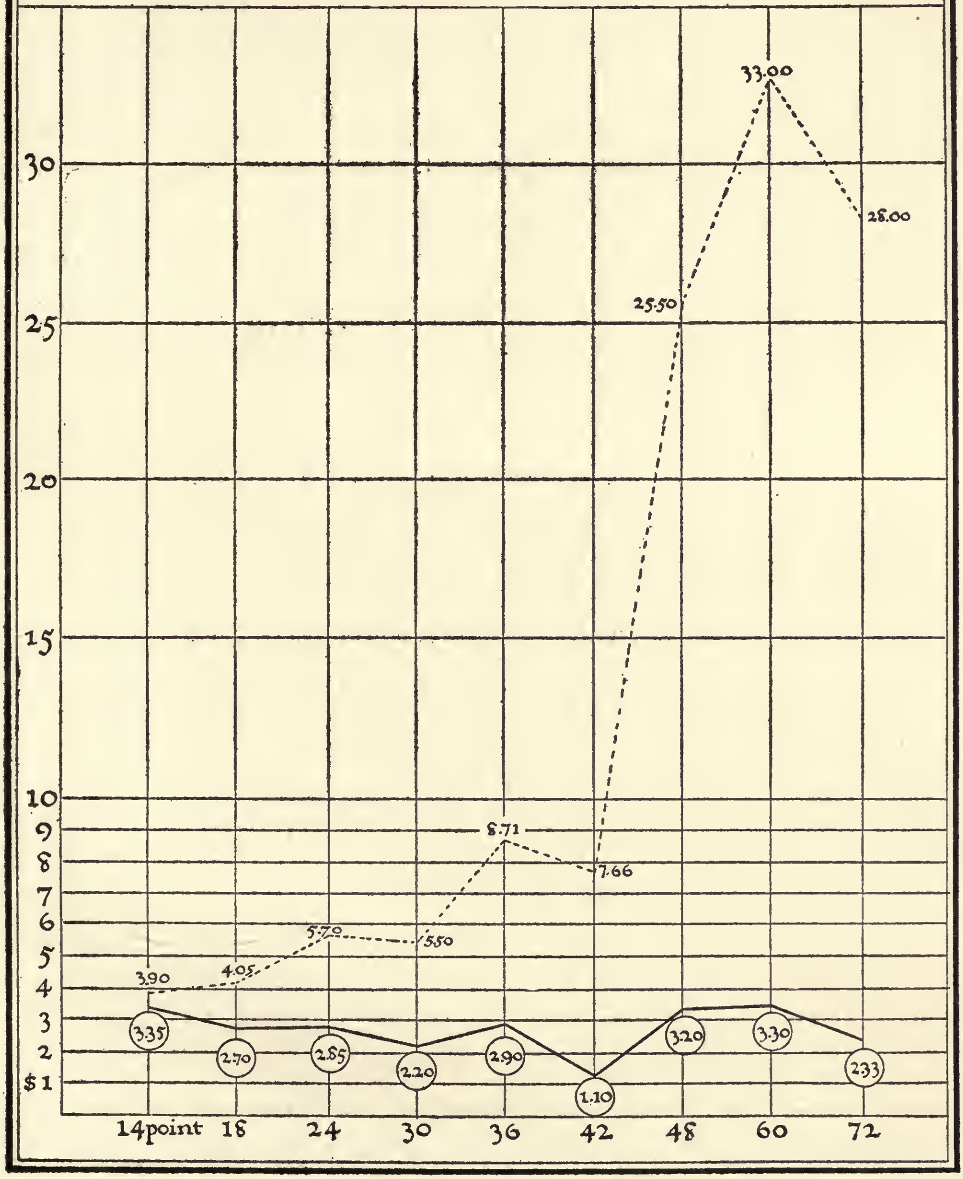
The effect of this method of measuring in averaging the rates to represent actual conditions can be shown by taking the rates as given in Table 4 and modifying them by the necessary factor. (Of course these rates are taken by way of example only, the actual rates corresponding to the average rate of $2.54 per thousand ems in Table 18 would show a similar although not the same variation).

Point size	Rate in Table 4	Modifying factor	Measured em rate
14	$ 3.90	12–14	$3.35
18	4.05	12–18	2.70
24	5.70	12–24	2.85
30	5.50	12–30	2.20
36	8.71	12–36	2.90
42	7.66	6–42	1.10
48	25.50	6–48	3.20
60	33.00	6–60	3.30
72	28.00	6–72	2.33

The "straightening process" is shown clearly in the chart in which the two sets of rates in the above table are charted.

To apply this method to the product of 630M actual ems shown in Table 18, it is necessary to apply a similar set of factors to those which were applied in the preceding table to the amount of composition in the sizes named. For our purpose of estimating the increased "emage" of the hand setting department, we may use the figures from Table 6 and Chart C, although these do not include the type used on the insurance work which is mainly

CHART F "MEASURED EMS"



special faces of smaller than 14 point. The results are as follows:

Point size	Actual ems	Modifying factor	Measured ems	Increase
14	60M	14–12	70M	10M
18	60	18–12	90	30
24	20	24–12	40	20
30	10	30–12	25	15
36	7	36–12	21	14
42	3	42–6	21	18
48	2	48–6	16	14
60	1	60–6	10	9
72	1	72–6	12	11
	164M		305M	141M

The 630M actual em product will be augmented by 141M ems due to this method of measurement, an increase of 22.4 per cent of measured ems over actual ems. The average cost rate for hand setting the year's product, shown in Table 18 as $2.54 on the basis of 630M actual ems becomes ($1598 divided by 771M) $2.07 per thousand measured ems.

MEASURING THE PRODUCT OF OTHER OPERATIONS

Since the make-up product is based on the total number of machine set and hand set ems handled, the make-up product in measured ems is (3645M ems machine set plus 771M ems hand set) 4416M ems. This gives a new rate for make-up as ($2880 divided by 4416M) 65 cents per thousand measured ems.

The lock-up product is the same as the make-up product except for 700M actual ems insurance work which takes no lock-up.

This may be figured at an advance of 50 per cent or 1050M measured ems and when deducted from the 4416M ems make-up product leaves 3366M ems representing the lock-up product. The lock-up rate will then be ($748 divided by 3366M) 22.2 cents per thousand measured ems.

Table 19 shows the budget with these changes in the product line and also the changes in rates. Table 18 is repeated for easy comparison.

USING COMPOSING ROOM COST RATES

The list of rates just given represents the composing room cost rates after the functional form of management has been perfected to the point indicated. In setting rates to use during the period when this form of management is in process of perfecting we cannot, of course, take these rates as they stand, for that would be assuming that the efficiency of operation were already secured, and the benefits passed on to the customer.

Nor should we take these rates and increase them by the percentage which represents the difference between these and the present cost rates. This for the reason that any new rates that are adopted will be based as far as the equipment is concerned on the new rather than the old investment. In other words, before these rates are to be put in effect at all the equipment function will have been standardized to the extent outlined. The standardization of the other functions, however, consists mainly of increasing the efficiency with which work is done, and until these standards are actually reached in practice the cost rates would best be based on present efficiency. To get at figures to represent such rates we

TABLE 18 *Costs by functions*

		Key-board	Composition casting	Type making	Hand setting	Make-up	Lock-up	Time work	Cuts
Operating equipment.	$10812	$ 770	$3205	$2939	$1458	$ 815	$ 625	......	$1000
Operating floor space.	817 ft.	66 ft.	92 ft.	44 ft.	150 ft.	168 ft.	144 ft.	......	153 ft.
Product handled.....	......	2430M ems	2430M ems	21000 lbs.	630M ems	3060M ems	2360M ems	425 hours	45000 inches
Function of equipment:									
Operative equipment use........	$1951	$ 139	$ 580	$ 530	$ 262	$ 147	$ 113	......	$ 180
Rent of floor space..	540	44	61	29	99	111	95	......	101
Supplies...........	190	25	50	50	10	10	10	$ 10	25
Equipment service..	1285	......	129	64	152	425	322	64	129
Cuts purchased....	1500	......	......	......	......	......	......	......	1500
Total...........	5466	208	820	673	523	693	540	74	1935
Function of operation:									
Pay roll for operation	2239	636	252	210	374	276	84	227	180
Function of control:									
Control of operation	489	116	81	70	70	58	12	47	35
Function of design:									
Equipment use, rent, supplies and control	369	26	......	......	55	263	18	......	7
Pay roll for design..	910	60	......	......	139	643	47	......	21
Total...........	1279	86	......	......	194	906	65	......	28
Function of comparison:									
Equipment use, rent, supplies and control......$303									
Payroll for cost keeping..... 360	663	166	113	93	93	66	19	66	47
Payroll for proof-reading..........	360	108	......	60	28	91	28	25	20
Total...........	1023	274	113	153	121	157	47	91	67
Total five functions..	$10496	$1320	$1266	$1106	$1282	$2090	$ 748	$ 439	$2245
Type making charged to hand setting and make-up..........	$10496	$1320	$1266	......	$1598	$2880	$ 748	$ 439	$2245
Rates..............		$.544 per M ems	$.52 per M ems	$.0527 per lb.	$2.54 per M ems	$.94 per M ems	$.297 per M ems	$1.03 per hour	$.0165 per inch

TABLE 19 *Costs by functions*

		Key-board	Composition casting	Type making	Hand setting	Make-up	Lock-up	Time work	Cuts
Operating equipment.	$10812	$ 770	$3205	$2939	$1458	$ 815	$ 625	......	$1000
Operating floor space.	817 ft.	66 ft.	92 ft.	44 ft.	150 ft.	168 ft.	144 ft.	......	153 ft.
Product handled.....	......	3645M ems	3645M ems	21000 lbs.	771M ems	4416M ems	3366M ems	425 hours	45000 inches
Function of equipment:									
Operative equipment use........	$1951	$ 139	$ 580	$ 530	$ 262	$ 147	$ 113	......	$ 180
Rent of floor space..	540	44	61	29	99	111	95	......	101
Supplies...........	190	25	50	50	10	10	10	$ 10	25
Equipment service..	1285	......	129	64	152	425	322	64	129
Cuts purchased....	1500	......	......	......	......	......	......	......	1500
Total...........	5466	208	820	673	523	693	540	74	1935
Function of operation:									
Pay roll for operation	2239	636	252	210	374	276	84	227	180
Function of control:									
Control of operation	489	116	81	70	70	58	12	47	35
Function of design:									
Equipment use, rent, supplies and control	369	26	......	......	55	263	18	......	7
Pay roll for design..	910	60	......	......	139	643	47	......	21
Total...........	1279	86	......	......	194	906	65	......	28
Function of comparison:									
Equipment use, rent, supplies and control......$303									
Payroll for cost keeping..... 360	663	166	113	93	93	66	19	66	47
Payroll for proof-reading.........	360	108	......	60	28	91	28	25	20
Total...........	1023	274	113	153	121	157	47	91	67
Total five functions..	$10496	$1320	$1266	$1106	$1282	$2090	$ 748	$ 439	$2245
Type making charged to hand setting and make-up.........	$10496	$1320	$1266	......	$1598	$2880	$ 748	$ 439	$2245
Rates..............		$.362 per M ems	$.348 per M ems	$.0527 per lb.	$2.07 per M ems	$.65 per M ems	$.222 per M ems	$1.03 per hour	$.0165 per inch

may refer to Table 19. The budget as shown in this table amounts to a total of $10,496, representing all functions standardized. We have noted in each of these various chapters on the different functions (except that on equipment) the probable saving that would result from standardizing that function. These savings were:

Function of control	$ 980
Function of design	778
Function of operation	558
Function of comparison	421
	$2737

We may take this sum of $2737 in the year's expense as representing the difference between present cost of work and the cost of work standardized. It will be noted that savings due to improved equipment do not appear here. If we add this $2737 to the standardized budget figure of $10,496, we have $13,233 to represent the budget under present conditions with the one exception of standardized equipment.

We can check this figure by referring to our original budget shown in the revised form of Table 1, page 44, where the total is $12,285. This does not include the $1500 for cuts purchased. If we add this item we have $13,785. Subtracting, now, the $552 which represents the saving due to standardized equipment, we have $13,233 as representing a present working budget with equipment alone improved.

Comparing this $13,233 with the budget as shown in Table 19 ($10,496) we see that it is 26.1 per cent higher, which suggests that the rates as given in Table 19 might be raised 26.1

per cent and become usable composing room cost rates as soon as the equipment changes are made.

The following shows the rates as given in Table 19 augmented by 26.1 per cent:

Keyboard work, per thousand measured ems	$ .46
Composition casting, per thousand measured ems	.44
Type making, per pound	.07
Hand setting, per thousand measured ems	2.61
Make-up, per thousand measured ems	.72
Lock-up, per thousand measured ems	.28
Time work, per hour	1.30
Handling cuts, per square inch	.02

Monotype composition is thus seen to have a manufacturing cost of 90 cents per thousand measured ems, keyboarded, cast, proofread and corrected. If made up (including the lay-out) and locked, the complete cost of one thousand measured ems of monotype matter is $1.90.

Hand set type complete, made-up, and locked, figures $3.61 per thousand measured ems.

SELLING EXPENSE AND PROFIT

To use these rates for estimating the selling price of composing room products we must consider the addition of two important items, namely selling expense and profit.

The customary method of figuring selling expense and profit into the selling rates is to ascertain what percentage of the manufacturing cost these items are and add this as a flat percentage, or two separate percentages, to all manufacturing costs to get the selling rates. Thus in case the composing room rate were $1.28, and the selling expense were figured out to be 25 per cent, this 25 per cent would be applied to the $1.28 as an increase of 32 cents, making the complete cost of manufacturing and selling the composing room product $1.60. If a 25 per cent profit were set as the aim (which is equal to a 20 per cent profit on the selling price) then the final selling price would be this $1.60 increased by 25 per cent, 40 cents, or $2.00.

This method of handling selling expense and profit is beautifully simple and very easy to put in practice, but the resulting rates are very far from accurate for the simple reason that selling expense is not connected with manufacturing costs in any natural way. Selling expense and profit are in no way directly connected with manufacturing costs. Manufacturing costs can be reduced to a definite rate or set of rates which represent actual facts of a very exact nature, but selling expense can only be added to these cost rates by some purely arbitrary and artificial means. Selling expense may be ascertained to be a certain percentage of manufacturing expense, but this relation is established only by ascertaining the manufacturing cost and the selling cost independently and bringing them together to find the percentage. Selling expense and profit are not natural percentages of manufacturing expense and can never be made so by bookkeeping.

Since it is desirable to have a selling rate that shall include manufacturing costs, selling costs and profit, it is necessary to figure out a method of adding the last two items to the first which as far as possible takes into account all the actual facts.

Let us first ascertain the amount of the selling expense and see what it represents.

At present the selling expense, and this includes all expense in selling the product not included in the manufacturing expense, is represented by 25 per cent burden on the composing room assumed hour cost of $1.50. On the basis of 8040 productive hours for the year this expense burden amounts to $3015 for the composing room share of the total selling expense.

The question, then, is how to add $3000 to the cost rates for the composing room.

The objection to adding this as a straight percentage is that no one dollar of this selling expense was actually incurred for selling four dollars worth of composing room product. Some of the composing room product was for jobs on which there was no selling expense beyond the routine estimating, billing and collecting, and other composing room product undoubtedly required considerably more than one dollar's expense for each four dollars in the department cost.

We can get at a more satisfactory basis of allotting this selling expense if we consider the total business done in a year for the entire shop as divided into two classes: one class, the business that may be said to be already sold or that sells itself without more than routine selling attention, which we may call house business; and the other class, the business that results from definite sales effort and advertising, which may be called new business.

As a guess I would estimate that these two classes were about equal, that is, that last year the total business was made up equally of house business and new business.

But the selling expense was not equally divided between these two classes. As a guess I would estimate that half the total expense was spent on the routine handling of all jobs (estimating, correspondence, sending proofs, delivery, billing, etc.) and the other half spent in the direct sales effort for new business (advertising, salesman's calls, etc.).

Considering only the composing room share of the total expense, these two considerations would have this effect on the division of the $3000: $1500 would be distributed equally over all the product and $1500 would be distributed on that half of the product representing new business. In percentages this would be ($1500 divided by the whole budget, $13,233) 11.3 per cent on all the product and ($1500 divided by half the budget, $6616) 22.6 per cent additional on half the product. That is, 11.3 per cent would have to be added to composing rates to get the complete cost of manufacturing and selling for house business, and 33.9 per cent would have to be added to these same rates to get the complete cost for new business. Using even percentages we can call these two items 11 per cent and 34 per cent.

These percentages added to the cost rates are shown in the following table (even cents being used):

	Manufacturing cost	Manufacturing and selling cost House business	Manufacturing and selling cost New business
Keyboard work	$ .46	$ .51	$ .62
Composition casting	.44	.49	.59
Type making	.07	.08	.09
Hand setting	2.61	2.90	3.50
Make-up	.72	.80	.96
Lock-up	.28	.31	.37
Time work	1.30	1.44	1.74
Handling cuts	.02	.02	.03

These rates may now become selling rates by the addition of a profit item, and here we wish to add not a flat percentage but a percentage which will take into account the size unit that is sold, whether larger or smaller than the average.

There were approximately 3000 different jobs in the product of last year which makes the average size unit sold, in terms of composing room manufacture cost around $4. It is clear that the bulk of the business at present, as far as the composing room is concerned, is done in units whose manufacturing cost is less than $10. If 25 per cent profit is added to the two sets of cost rates we shall get two new sets of rates that may be said to be the proper selling rates for the product in units of $10 (manufacturing cost) or less. In case the unit of product is larger than $10 it is reasonable to suppose that the selling expense item for that particular product will actually show a profit over the estimate. This is because the actual selling expense on a $10 item and, say, a $100 is very nearly the same, whereas in using the cost rates as given above the selling expense item is charged to the job on the basis of ten times as much in the case of the $100 job as in the case of the $10 job. It is suggested that an addition of 10 per cent to the manufacturing and selling rates as given above for items of composing room cost of more than $10 up to $100 would show a reasonable profit return. For jobs whose composing room cost unit was more than $100 and less than $1000 the profit percentage might be 5 per cent, while above that special rates might be made if occasion should warrant. The composing room rates, then, for manufacture, for manufacture and selling, and for final selling price, based on these considerations would read as given in Table 20. The prices of combinations of certain of the operations are also given.

TABLE 20 *Composing room rates*

	Manufacturing cost	House business				New business			
		Cost	Sales $1—$10	Sales $10—$100	Sales $100—$1000	Cost	Sales $1—$10	Sales $10—$100	Sales $100—$1000
Keyboard work........	$ .46 M ems	.51	.64	.56	.53	.62	.78	.68	.65
Composition casting...	.44 M ems	.49	.61	.54	.51	.59	.74	.65	.62
Type making..........	.07 lb.	.08	.10	.09	.08	.09	.11	.10	.09
Hand setting..........	2.61 M ems	2.90	3.63	3.19	3.05	3.50	4.38	3.85	3.67
Make-up.............	.72 M ems	.80	1.00	.88	.84	.96	1.20	1.06	1.01
Lock-up..............	.28 M ems	.31	.39	.34	.33	.37	.46	.41	.39
Time work............	1.30 hour	1.44	1.80	1.58	1.51	1.74	2.17	1.91	1.82
Handling cuts.........	.02 inch	.02	.03	.02	.02	.03	.04	.03	.03
Machine composition...	.90 M ems	1.00	1.25	1.10	1.04	1.21	1.52	1.33	1.27
Machine composition made-up and locked...	1.90 M ems	2.11	2.64	2.32	2.21	2.54	3.18	2.80	2.37
Hand composition, made-up and locked...	3.61 M ems	4.01	5.02	4.41	4.22	4.83	6.04	5.32	5.07
Electros which cost 3c..	.05 inch	.05	.06	.05	.05	.06	.07	.06	.06
Zincs which cost 6c....	.08 inch	.08	.09	.08	.08	.09	.10	.09	.09
Halftones which cost 15c	.17 inch	.17	.18	.17	.17	.18	.19	.18	.18
Type making, including metal at 15c.........	.22 lb.	.23	.25	.24	.23	.24	.26	.25	.24

ESTIMATING

The subject of estimating, or the use of these selling rates in actual practice, is entirely outside the scope of this report which is concerned with composing room manufacture only. But I can not refrain from adding at this point a few observations as to the use that may be made of the rates in determining house policies.

In employing these rates in practice the procedure would naturally be to consider each rate in relation to general market conditions and, after taking all aspects of the matter into consideration, such as the effect of increased volume on that particular rate, the ease with which increased production could be handled, the effect of increased production on the amount of necessary investment and floor space, to determine the final rate to become the permanent basis for estimating. It will be noted, for example, that machine composition at the present volume of business, does not give a selling rate which will compete with advantage with the selling rates of the trade plants of the city. Even increased production to a full capacity for the machine on a single shift would not probably produce a selling rate which was lower than those of the trade plants. In this case market conditions may be said to be such that there is no attraction in pushing machine composition as a trade proposition, but there undoubtedly is a big field where made up display matter, largely the product of the machine, can be profitably marketed at the combined rates as given.

In the case of general display composition, where the value of the lay-out is important, the selling price as measured by the thousand ems, is probably lower than the average market price charged for the same work if estimated and sold on an hour basis. In fact, by the simple measurement of a number of jobs of display composition, both in ems and in square inches, a square inch rate could be ascertained which would be a safe average and used in the estimating of display work. Such a rate as 10 cents for less than $100 items of new business, for instance, might be found (when checked up in each case on the ticket where the cost is always figured in measured ems) to be a safe estimating figure and at the same time a figure at which this class of work could be readily sold.

COST AND EFFICIENCY RECORDS

The entire cost keeping system is composed of records of two classes: those having to do with ascertaining the cost of individual jobs so that proper charges can be made to the customer, and those having to do with keeping track of the cost of manufacturing the product from day to day.

The first class of records, for ascertaining individual job costs, involves the use of proofs of all eight departments of work showing product, which are first entered on the composing room time sheets according to the individual job numbers and then transferred to the individual job cost sheets. On completion of the job the product records are summarized, the assumed rates applied, selling and commercial expense and profit added, and the whole entered into the general books of account as a charge to the customer and a credit to each manufacturing account as well as selling and commercial expense and profit.

The second class of records, for keeping track of the cost of manufacture from day to day, involves the composing room time

FORM A

TIME SHEET

NAME	DATE	TOTAL HOURS	WAGES

JOB Nº	TIME		DESIGN					OPERATION								CORRECTIONS				PROOF READING							COST KEEPING	EQUIPMENT	CONTROL	PRODUCT
			For Keyboard	For Handsetting	For Make-up	For Lock-up	For Cuts	Keyboard	Comp. Casting	Type making	Hand setting	Make-up	Lock-up	Time work	Cuts	For Keyboard	For Handsetting	For Make-up	For Lock-up	For Keyboard	For Type making	For Hand setting	For Make-up	For Lock-up	For Time work	For Cuts				
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	Keyboard			Comp. Cast.			Type-making			Hand setting			Make-up			Lock-up			Time work			Cuts		
	Hrs	Wages	Ems	Hrs	Wages	Ems	Hrs	Wages	Lbs	Hrs	Wages	Ems	Hrs	Wages	Ems	Hrs	Wages	Ems	Hrs	Wages	Hrs	Hrs	Wages	Inches
Design																								
Operation																								
Proofread																								

Cost Keeping		Equipment		Control	
Hrs	Wages	Hrs	Wages	Hrs	Wages

sheets, with the record of the entire pay roll and product for the day, the records of cuts purchased, the composing room daily report which is a summary of the time sheets and cuts purchased record, a cumulative graph for the month for each of the eight departments of work showing the fluctuations in rate (as compared with the assumed rate) from day to day, and a cumulative graph for the month showing the volume of business, by departments from day to day.

The general books of account, when balanced at the end of each month give the verification of the manufacturing cost records. These records will now be described in detail.

THE COMPOSING ROOM TIME SHEET

The arrangement of the composing room time sheet is shown in form A. This is designed to be the daily record of each individual whose time is directly or indirectly charged to the composing room pay roll.

It is primarily the record of every hour purchased for the composing room work, and space is provided for every form of activity for which wages can be paid on the composing room pay roll. It is absolutely essential that every dollar of the composing room pay roll be accounted for on these time sheets and no wages paid without having this record of what the wages are paid for.

This form is designed so that the record of time and product can be filled in by the workman just as is at present the custom, but the same form can be used if the plan is developed of having work orders showing time and product standards issued in advance and simply stamped with "time begun" and "time finished." In this case the cost clerk uses the composing room time sheet to summarize the work orders.

In using this ticket the workman fills in the job number of the job he is about to work on and draws a line through the time figure representing the time when he starts. On completion of the operation in hand he draws another line through the hour figure representing the finishing time and then in the proper column for the operation he has been engaged upon he draws a vertical line connecting the lines corresponding to beginning and ending time. He also notes in the product column the product (measured according to standard instructions). On commencing the next operation he records the new job number and sees that one job starts exactly where the last job left off. There must be a vertical line representing every tenth hour of the day to entitle the workman to a total of 8 hours' pay, any "skipped spaces" mean work in another department or no work at all.

It will be noted that while every operation that is part of the direct or indirect work of the composing room is given a column on the time sheet, there is no column marked "miscellaneous" for the workman to record time in for which he cannot find an appropriate heading.

The reason for this is important. We have seen in the discussion on the function of control that all unutilized time in the department is to become a charge against the function of control. That is to say, the function of control is primarily concerned in adjusting the pay roll to the work in hand. A five per cent lee way was figured as a basis of standardized operation. Under the plan of routing suggested the workman reports to the superintendent, at the conclusion of each piece of work assigned to him, for his next job. If there is no job to give him the superintendent is under the necessity of telling him to remain idle and record his idle time in the column on the time sheet marked for control. The workman has no authority to charge his time in any column except as directed when work is given out, so there is no question of a workman's charging his idle time to control unknown to the superintendent. If an accident occurs, such as a break down on the monotype, for instance, that prevents operation for, say, an hour to half a day, while a new part is secured or repaired, the workman on the machine is under necessity of reporting at once to the superintendent because he has no place on his time sheet to record his time unless he gets authority to charge it to control. As the superintendent is also the authority on the function of equipment he immediately takes steps (in such a case) to have the repairs made, and as the head of the function of control, routes other work to the workman during the time the repairs are being made. If the superintendent decides to have the repairs made by the same workman he authorizes him to charge his time in the equipment column.

There is no product record for the time recorded in cost keeping, equipment service, or control, as these are in the nature of general charges against the whole department and not against any one of the eight operative divisions.

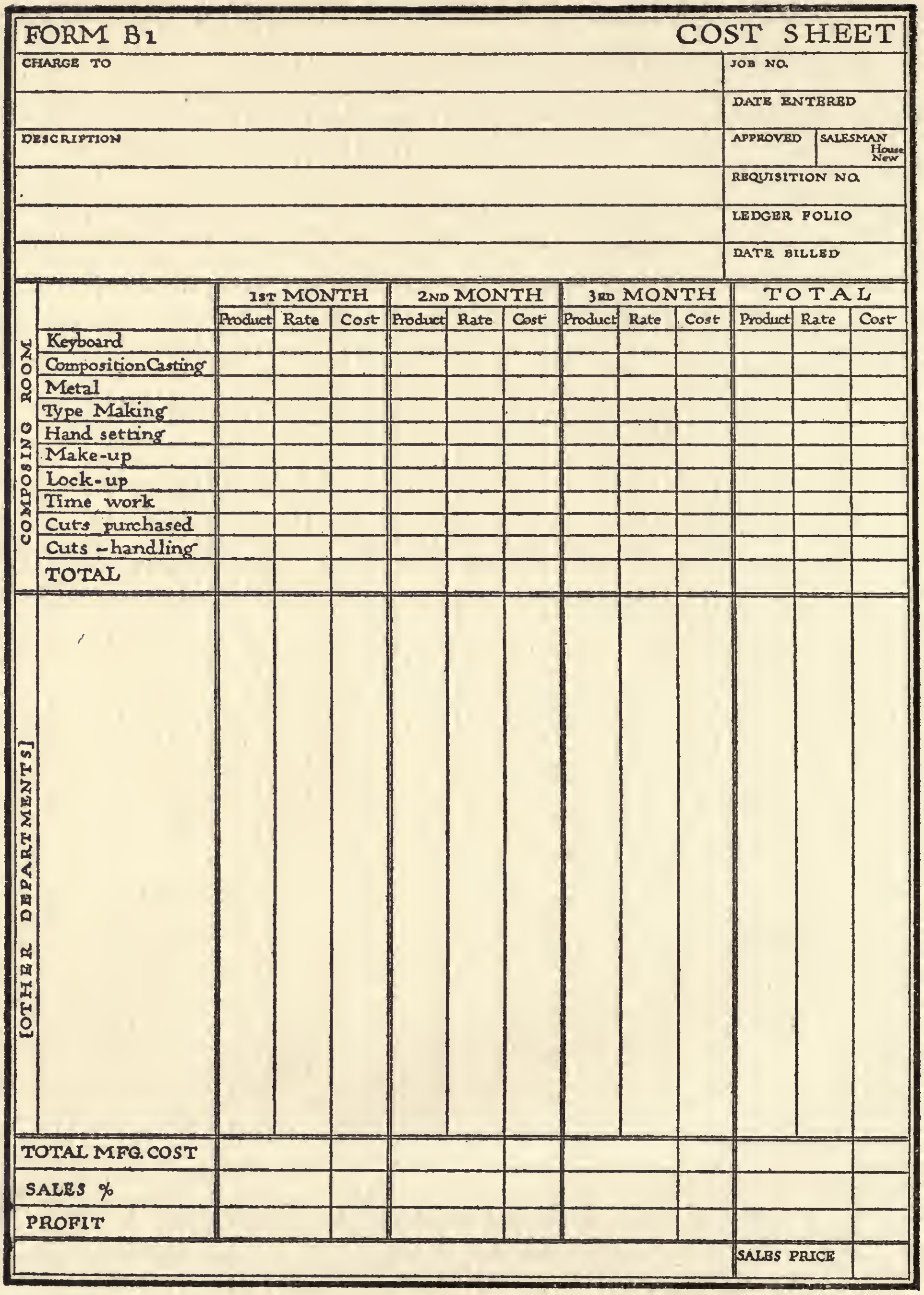
The cost clerk receives each morning the time sheets, the record of cuts purchased, and proofs of all work done in the eight departments of work. From the proofs she verifies each of the product notations on the time sheets, correcting if necessary, and then fills in the summary of time and product at the foot of the ticket. The total hours space has already been filled in by the superintendent as his OK on the time sheet. The proofs from the cut department are used to check the cuts purchased record. The set of time sheets and the cuts purchased record sheet for the day thus become the complete original record for the entire subsequent cost and efficiency records.

THE INDIVIDUAL JOB COST SHEET

This form, shown as Form B 1 (the front) and B 2 (the reverse), is similar to the present cost sheet except that it is arranged to give the product record in measured ems, pounds, hours, or inches, instead of hours only.

The record of product as given on the set of time sheets and cuts purchased sheet for the day is transferred to Form B 2. In the case of time work space is provided for noting what kind of work was done, as this is the only case where the physical product cannot be measured. The proofs of all measured product are part of the permanent records of the department and can be referred to at any time by ascertaining the date from the cost sheet. Proofs of author's changes are also included so that if time work is recorded as author's changes the proof can be referred to. Time work other than author's changes, such as extra proofreading, or designing, has no physical product record, hence the necessity of watching carefully against inaccurate reporting of time work. This space for the description of time work is a safeguard for the purpose.

The totals from the different columns on Form B 2 are transferred, on completion of the job to form B 1 the front side of



FORM B1 **COST SHEET**

CHARGE TO	JOB NO.
	DATE ENTERED
DESCRIPTION	APPROVED | SALESMAN House New
	REQUISITION NO.
	LEDGER FOLIO
	DATE BILLED

		1ST MONTH			2ND MONTH			3RD MONTH			TOTAL		
		Product	Rate	Cost	Product	Rate	Cost	Product	Rate	Cost	Product	Rate	Cost
COMPOSING ROOM	Keyboard												
	Composition Casting												
	Metal												
	Type Making												
	Hand setting												
	Make-up												
	Lock-up												
	Time work												
	Cuts purchased												
	Cuts – handling												
	TOTAL												
[OTHER DEPARTMENTS]													
TOTAL MFG. COST													
SALES %													
PROFIT													

	SALES PRICE	

FORM B2

COST SHEET

COMPOSING ROOM

DATE	Keyboard	CompCast	Metal	Type mk	Hand set	Make-up	Lock-up	Time work		Cut p.	Cuts h.
TOTALS											

OTHER DEPARTMENTS

the cost sheet. Space is provided for jobs to extend through three months' time although ordinarily but one column need be used. This is for the reason that the tickets are planned to be summarized at the end of each month and totaled for "work in progress." As work in progress is figured at manufacturing cost plus selling and commercial expense (but not profit) it is desirable to arrange for totaling the manufacturing expense and adding the selling and commercial expense percentage without confusing the final summary of cost as shown on the ticket. The record on the back can be summarized at any point in the columns, or if the job actually takes more records than there is space provided a separate sheet (of Form B 2) can be added for each month's work.

The rates used are, of course, the assumed composing room cost rates for each of the eight departments. The percentage for selling and commercial expense is determined for each job by the fact of its being a "house" job or "new business" (as noted at the time the job is entered).

Form B 1 would also serve as a convenient form of estimating blank. If printed on page one of a four page manila folder, the blank pages could be used for the figuring necessary in arriving at the quantities etc., and all memoranda or loose papers enclosed in the folder when filed. The four sets of columns, first month, second month, etc., could be used for different quantities such as 500, 1M, or 5M. The rates used in figuring would naturally be the final selling rates in which case the summary opposite "total manufacturing cost" is the normal selling price of the job. If the estimating is done on actual cost rates and the percentages added, then the estimate for a job would agree, entry for entry, with the cost sheet of the job after completion. It would be a convenience

FORM C – REPORT

DATE	DAY'S PROFIT	CUMULATIVE PROFIT

	NAMES	Keyboard		Compcasting		Type making		Hand setting		Make-up		Lock-up		Time work		Cuts	
		Wages	Product	Wages	Product	Wages	Product	Wages	Product	Wages	Product	Wages	Product	Wages	Product	Wages	Product
DESIGN																	
	Fixed expense																
	Totals																
	Cost per unit																
OPERATION																	
	Totals																
	Cost per unit																
COMPARISON																	
	Fixed expense																
	Totals																
	Cost per unit																
	Equipment fixed expense																
	Control fixed expense																
	Total cost per unit																
	Day's profit																
	Cumulative profit																

COMPARISON	Wages	EQUIPMENT	Wages	CONTROL	Wages
Fixed expense					
Total					
Assumed cost					

DAY'S PROFIT					
CUMULATIVE PROFIT					

in comparing estimates with cost sheets to have them in similar form.

COMPOSING ROOM DAILY REPORT

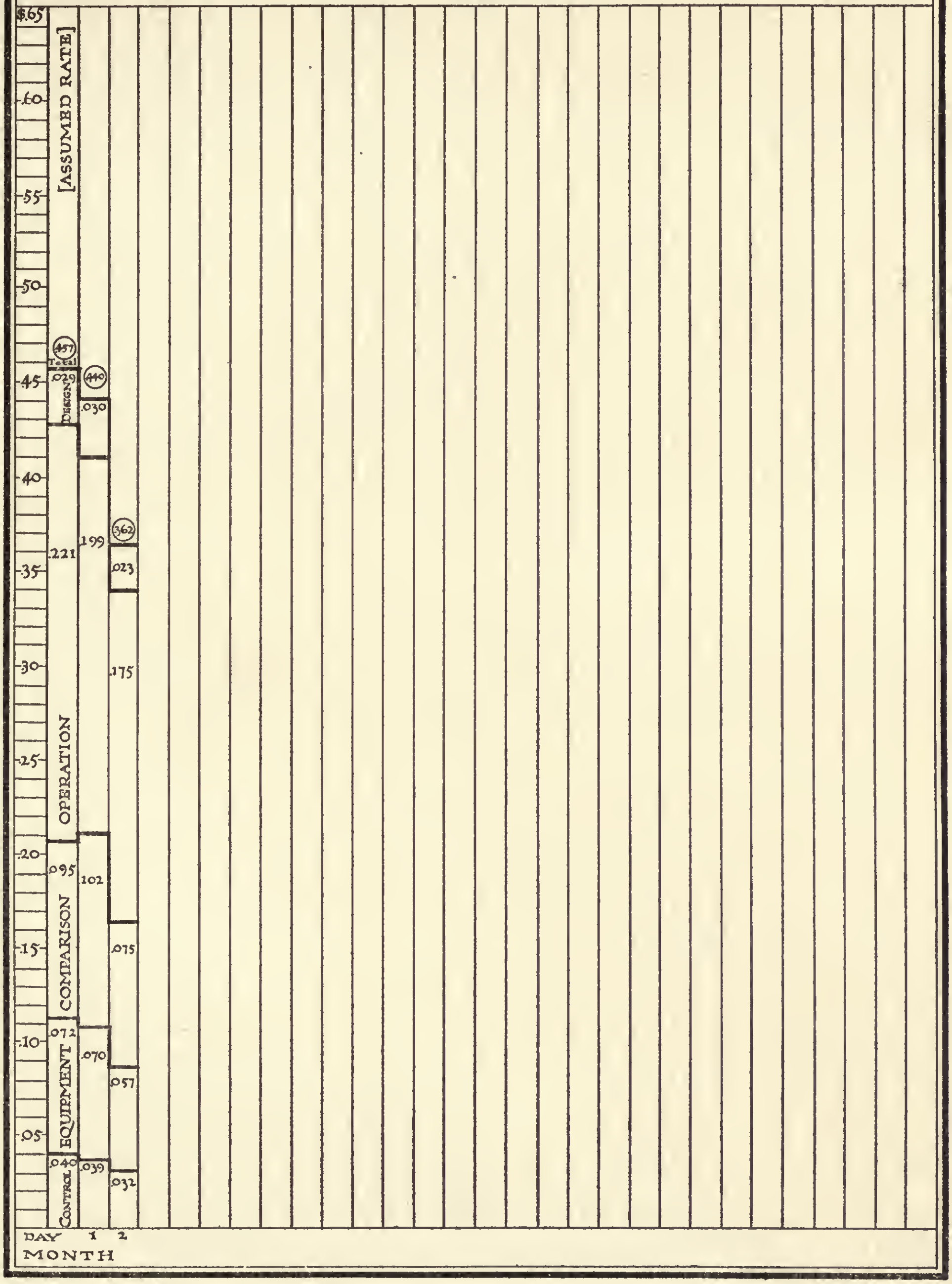
The composing room daily report is shown as Form C. This is simply a summary of the time sheets and cuts purchased sheet arranged so as to include all other composing room expense as well. It will be noted that the equipment and control expense for design, control and the cost keeping expense of comparison and the entire functions of control and equipment are regarded as fixed expense and charged in the different columns on the basis of the amount of product produced for the day. This gives a cost rate for each of the eight departments for the day, which, when compared with the assumed cost rates, shows a gain or loss in manufacturing profit. To check the correctness of the fixed rates the total expense for each function is given separately and a comparison of these totals with assumed totals gives a further item of gain or loss in manufacturing profit.

TREND OF COST RATES

The effect of the gain or loss in manufacturing profit as determined by the rates is shown in the graph (Form D). This shows the rate only and takes no account of the number of units of product produced in the day.

A separate sheet for each of the eight operations of the composing room may be kept, the set of graphs thus giving a very comprehensive presentation of the efficiency of production from day to day. The analysis of each rate is shown in this chart. A

FORM D KEYBOARD COST RATE



glance at the diagram shows clearly the proportion each function has in making up the total rate.

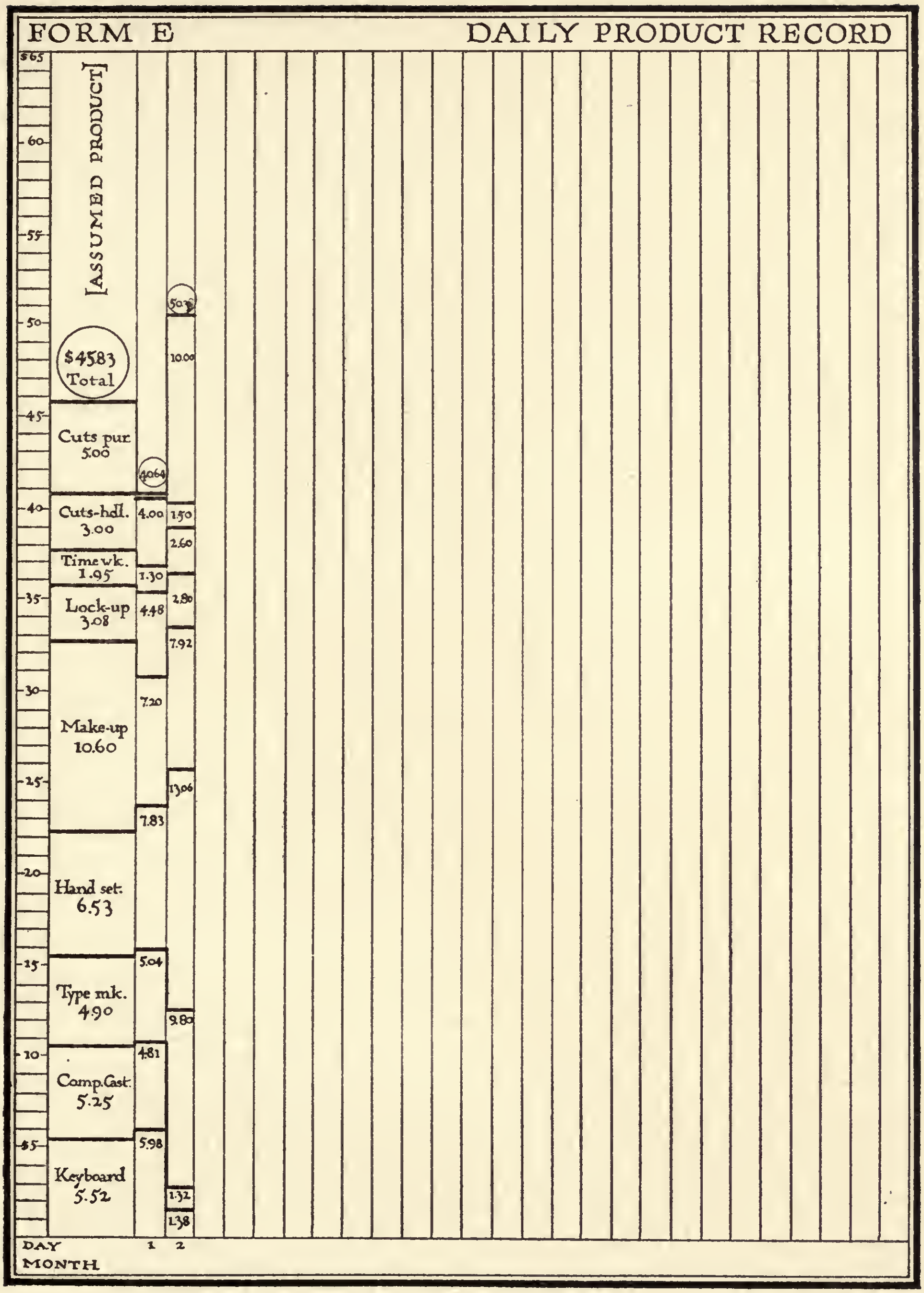
PRODUCT RECORD

To show the trend of the total gain or loss in manufacturing profit another graph is suggested in the form of a record of total product from day to day of each of the eight kinds of product with its profit over assumed costs shown separately and the whole combined into one product record. If the solid black is taken to represent manufacturing profit and red is used to indicate a loss then the area of solid black shows the total profit and the area of red indicates loss.

By dividing the assumed product for each the eight kinds of operation by 300 we get an estimated daily average of product which multiplied by the different rates gives the following for average daily product at assumed cost rates:

Keyboard work, 12M ems at $ .46	$ 5.52
Composition casting, 12M ems at $ .44	5.25
Type making, 70 pounds at $ .07	4.90
Hand setting, 2.5M ems at $2.61	6.53
Make-up, 14.75M ems at $ .72	10.60
Lock-up, 11M ems at $ .28	3.08
Time work, 1.5 hours at $1.30	1.95
Handling cuts, 150 inches at $ .02	3.00
Cuts purchased	5.00
	$45.83

In the illustrations these two graphs are filled in with a couple of days' records as examples of how the chart will look.


FORM E
DAILY PRODUCT RECORD
$65
60
55
50
45
40
35
30
25
20
15
10
5
[ASSUMED PRODUCT]
$4583 Total
Cuts pur. 5.00
Cuts-hdl. 3.00
Time wk. 1.95
Lock-up 3.08
Make-up 10.60
Hand set. 6.53
Type mk. 4.90
Comp. Cast. 5.25
Keyboard 5.52
4064
4.00
1.30
4.48
7.20
7.83
5.04
4.81
5.98
50.38
10.00
1.50
2.60
2.80
7.92
13.06
9.80
1.32
1.38
DAY
MONTH
1
2